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THE SURGICAL CLINICS OF NORTH AMERICA

Volume 1

Number 3

CLINIC OF DR. EDWARD H. NICHOLS

BOSTON CITY HOSPITAL

HEAD INJURIES

THE cases which are to be shown or reported this morning illustrate the various common types of head injury. It must be remembered that the injury of the brain in head cases may be slight or severe, may produce symptoms of brain injury varying from a very temporary loss of consciousness to death from profound destruction, although practically all cases of brain injury are characterized by some interference with the mentality either temporary or long continued, immediate or delayed, for a variable time after the injury. In any event, it is to be remembered that the injury of most consequence is the injury to the brain and not the injury to the brain box—in fact, very severe injury to the brain box may be associated with almost no signs of brain injury. For convenience of description the different injuries are classified as follows:

1. Contusion of the brain.
2. Fracture of the bony vault.
3. Fracture of the base of the skull.
4. Laceration of the brain.
5. Intracranial hemorrhage.

CONCUSSION OF THE BRAIN

Characterized by signs of temporary interference with mentality with temporary injury to the brain, with no evidence of injury to the brain box.

S. M. S. Medical College, 1897
JAN 17 1897

During the past year there have been on my service at the hospital the following cases classified as concussion

Number	Well	Operated	Died	Operated—died
22	21	1	1	1

The lesions in cases of concussion is believed to be an increase of fluid ("edema") of the brain due to the shaking up of the brain produced by violence. The simplest type of this lesion is illustrated by Case I who was brought to the hospital forty eight hours ago and who will be discharged today

Case I.—A. S. forty five, laborer. At 9 A. M. forty-eight hours ago he was heaving on a tackle in the hold of a ship when the fall parted and the broken end struck him a violent blow on the side of the head, knocking him unconscious. He was at once brought to the hospital, and on admission, twenty minutes later was still unconscious, but recovered consciousness in about ten minutes for a short time he was dazed but in twenty minutes more he was perfectly conscious and rational. There was at no time paralysis, nor any bleeding from mouth, nose, or ears, and no evident external contusion or wound. The pupils were equal and reacted to light, but the reaction was rapid and considerable in amount there was neither strabismus nor nystagmus. Abdominal and cremasteric reflexes and knee-jerks were present and equal, there was no ankle-clonus Babinski, or Oppenheim. The patient was kept quiet in bed, given 1 ounce of salts, and for the first twenty-four hours given a light diet. The order left in the order book reads, 'Rest in bed quiet milk diet, salts 1 ounce. Watch carefully for stupor unconsciousness twitchings convulsions, marked change or inequality of pupils and for any paralysis and pulse below 60. Immediately report if any of these symptoms appear. Keep three hour blood-pressure chart and hourly pulse. This was maintained for twenty-four hours. At the end of that time the only complaint was a slight headache, and the patient was allowed out of bed. There has been no rise of temperature. The x-ray showed no fracture. The blood-pressure at this time has been above 120. This morning the patient shows nothing abnormal

except a slight tenderness of the right side of the head, and will be discharged today. He will however be requested to return to the nerve O P D in a few days for observation, and will be advised to avoid the use of alcohol.

Many concussion cases are as simple as this one seems. But it is not to be assumed that all cases are as trivial. Occasionally mental symptoms persist for days, and occasionally for months. Some of these cases are for some time easily confused by attempted mental exertion or study sometimes for months, and often should be forbidden, and never should be urged to hasten to begin mental exertion. That not all cases of concussion are trivial is shown by the following case.

Case II.—J McL seven male schoolboy. Was struck by a motor and at once brought to the hospital by the motor. On admission the child was semiconscious and restless. The pupils were dilated, equal but did not react to light, blood was flowing from mouth and nose, none from ears. There were no abdominal or cremasteric reflexes. Later the right pupil became greater than the left, there appeared a double Babinski, and the right arm and leg became spastic. An immediate left osteoplastic temporo-parietal decompression was done under ether 7 cm in diameter. At operation no hemorrhage was found but the brain was injected boggy and bulging. The child died in seven hours. A medicolegal autopsy showed no fracture of the skull no laceration of the brain but swelling (edema) of the brain was general.

The symptoms of concussion vary a good deal but certain symptoms are constant. After an injury of greater or less severity there is evidence of mental disturbance varying from a very temporary confusion to profound unconsciousness which may last twenty-four or forty-eight hours or more. In relatively few cases there is an immediate period of great mental excitement, during which in exceptional cases the patient may be violent or even dangerous. In very slight cases the chief symptom may be a disorientation—the patient cannot tell his name the day of the week the date or the time of day. At this stage the pupils are equal usually react, and the reaction is usually violent. Most

During the past year there have been on my service at the hospital the following cases classified as concussion

Number	Well	Operated.	Died	Operated—discharge
22	21	1	1	1

The lesions in cases of concussion is believed to be an increase of fluid ("edema") of the brain due to the shaking up of the brain produced by violence. The simplest type of this lesion is illustrated by Case I who was brought to the hospital forty eight hours ago and who will be discharged today.

Case I.—A. S. forty-five laborer. At 9 A. M. forty-eight hours ago he was heaving on a tackle in the hold of ship when the fall parted and the broken end struck him violent blow on the side of the head, knocking him unconscious. He was at once brought to the hospital and on admission, twenty minutes later was still unconscious, but recovered consciousness in about ten minutes for a short time he was dazed but in twenty minutes more he was perfectly conscious and rational. There was at no time paralysis nor any bleeding from mouth, nose or ears, and no evident external contusion or wound. The pupils were equal and reacted to light, but the reaction was rapid and considerable in amount, there was neither strabismus nor nystagmus. Abdominal and cremasteric reflexes and knee-jerks were present and equal, there was no ankle-clonus, Babinski or Oppenheim. The patient was kept quiet in bed given 1 ounce of salts, and for the first twenty-four hours given a light diet. The order left in the order book reads, "Rest in bed, quiet, milk diet, salts 1 ounce. Watch carefully for stupor unconsciousness, twitchings, convulsions, marked change or inequality of pupils, and for any paralysis and pulse below 60. Immediately report if any of these symptoms appear. Keep three hour blood-pressure chart and hourly pulse. This was maintained for twenty-four hours. At the end of that time the only complaint was a slight headache and the patient was allowed out of bed. There has been no rise of temperature. The x-ray showed no fracture. The blood-pressure at no time has been above 120. This morning the patient shows nothing abnormal

fracture of the right occipital bone without depression or separation. There have been no notable symptoms since, and today the eighth day since the injury the patient is up for the first time. (The patient was discharged on the twelfth day with no abnormal symptoms.)

Except for the x-ray the case would have been considered a case of concussion. The relative unimportance of the fracture is evident.

Even in some cases of compound fracture the brain injury may be unimportant, as is shown by Case IV

Case IV —P C thirty-seven, male, a machinist, was struck on the top of the head by a trolley wheel, which fell about 9 feet. The patient did not lose consciousness, although he was dazed but walked to the hospital. He showed a scalp wound 1½ inches long over the vertex down to the bone at the bottom of the wound was seen and felt a linear fracture, without depression or separation. There were no abnormal reflexes except that the pupillary reflexes were very active. There was no paralysis. It was thought that the fracture involved only the outer table. The wound was cleaned and closed tight. This morning (the second day) the patient is perfectly clear the x-ray shows no evidence of fracture (although it was seen and felt yesterday) and he demands to leave the hospital. Temperature is 98.8° F

The slight importance of the *fractures* will be seen by examining the results of operation on these cases. Of the simple fractures, 2 were operated, and 2 died. Both of these cases were operated for the relief of pressure because of evidence of severe edema. Of the 19 compound fractures of the vault, 5 were operated and all lived. Of these 5 operated cases, in 4 instances the bone was elevated but the *dura was not opened*. This was because the evidence of brain injury was very slight. It was desirable to elevate the depressed bones, but it was not thought necessary to open the dura with the added risk of infection in the face of the negligible brain injury. The high percentage of recovery is believed to be due to the fact that the cases of compound fracture may automatically decompress the brain at the time of injury and prevent the occurrence of severe edema

of the deep reflexes are present and equal there is no clonus, Babinski or Oppenheim there is no paralysis most cases vomit. The disturbed mental condition lasts from a few minutes to forty-eight hours, rarely longer. In some instances restlessness is extreme. As the symptoms diminish headache is frequently complained of. There is usually little if any rise of temperature. This is important, as a marked rise of temperature usually indicates laceration of the brain. Nearly all of these cases recover without operation.

FRACTURE OF THE VAULT OF THE SKULL

Under these cases are included all cases in which fracture may be demonstrated, either by palpation inspection, or x ray. In a large proportion of these cases there will be some symptoms of temporary brain edema (concussion) but no evidence which permits localization of the brain injury. During a period of twelve months the following cases of this sort were admitted to the hospital on my service

	Number.	Well.	Operated	Died.	Operated—death.
Simple fracture	23	21	2	2	2
Compounded fracture	19	19	3	0	0

It should be emphasized again that the important feature of these cases is the character and extent of the brain injury. The fracture of the skull is usually of slight consequence. This is shown by

Case III.—R. L., twelve, male, a schoolboy. The child tripped and fell on the subway stairs, striking his head. Was brought at once to the hospital. On arrival he was semiconscious and vomited twice after admission. There was no paralysis. There was a marked hematoma over the right occiput. Pupils were equal, moderate size, and reacted vigorously; there was slight lateral nystagmus, which disappeared that same day. Systolic blood-pressure was 90. The child was restless during the day and early part of the night. On the second day the boy complained of photophobia, but examination of the fundus showed no swelling of the optic disks; the reaction of the pupils was still marked. The pulse, at first 90, dropped to 60; the temperature did not rise. x Ray on that day showed a linear

spinal fluid there could have been no laceration of the brain nor probably any intracranial hemorrhage. In other words, the brain injury was trivial and the fracture not important.

In many instances of fracture of the base, however the injury to the brain is severe and destructive, as shown in Case VI.

Case VI.—J. R. ten, male. On September 25 1920 was struck by an automobile, and within an hour was admitted. On admission the child was unconscious, but restless. Blood was flowing from nose and right ear. Temperature 97.4 F pulse 150 respiration 40. Child vomited frequently the vomitus was projectile in character the blood-pressure was 75/40. Pupils were equal and reacted no nystagmus. Abdominal reflexes and knee-jerks were absent there was a double Babinski. Within a few minutes after admission the child became pulseless after treatment for shock the pulse reappeared and was about 150 but the general condition was such that no operation was considered feasible the child died six hours after the injury. In this instance the brain injury was serious and must have been either severe edema or laceration of the brain there was no autopsy. The differential diagnosis was not important, as the child's condition was such as to have made no operation possible.

In some cases the fracture of the base may produce severe intracranial hemorrhage from a ruptured cerebral sinus, as shown by

Case VII.—R. F. twenty-eight, male, single. On September 27 1920 the man was drunk and fell in the street was at once brought to the hospital in the police ambulance. He was drunk unconscious, restless, noisy and unmanageable. Temperature 99.4 F pulse 100 respiration 28. There was a contusion behind the right ear. Pupils were equal and reacted. While patient was being examined a flaccid paralysis of the left face, arm, and leg developed the deep reflexes disappeared and the pulse fell to 70. Lumbar puncture showed serous fluid, at first clear but soon blood stained. An immediate right temporoparietal osteoplastic bone decompression was done, and an extradural clot was found arising from a demonstrable tear in the lateral sinus.

FRACTURE OF THE BASE OF THE SKULL

In these cases the prognosis is much worse than in cases of fracture of the vault. The reason for this is obvious, for in fracture of the base in many instances the fracture involves a sinus at the base of the brain and serious hemorrhage ensues. Moreover the histories show in most although not in all instances that the violence producing the injury is much more severe than in the cases of the fracture of the vault. As result the injury to the brain secondarily produced may be very destructive. In the cases classed as fractures of the base in all cases there have been signs of concussion (edema) and marked cerebral pressure (increased blood-pressure and profound unconsciousness) with a discharge of blood or serous fluid, or both from the ears. The cases of this type seen during the past year were—

	Number	Well	Operated	Dead	Operated—died
Simple	9	8	1	1	1
Compound	5	4	1	1	0

The type of injury seen in these cases is illustrated by

Case V—J J M twenty-three, male, single, chauffeur. The man had been drinking, fell in the street, striking his head on the curb and was at once brought to the hospital in the police ambulance. He was evidently drunk, conscious, but irrational. His pupils were equal and reacted. Blood was coming from nose and left ear. There was no paralysis. All reflexes were equal, but both knee jerks were sluggish. Blood-pressure was 130. Ear consultation showed "rupture of left ear drum, with probable fracture of base of skull, with bleeding from middle ear. The next morning the only sign of brain injury was unusually active pupillary reflexes. Nerve consultation shows "patient quite clear no focal signs. On third day (today) bleeding from ear has stopped, patient is perfectly clear and demands his discharge. At the time of admission the bleeding ear was irrigated, a cotton drain was inserted, and the ear was covered with sterile dressing. In this case the brain injury was probably concussion (edema) only. The hemorrhage may have been due to a slight rupture of a lateral sinus. Since lumbar puncture showed no blood in the

police ambulance. On arrival he was irrational, excited thrashing about, and not oriented. There was an obvious right frontal contusion. The right pupil was larger than the left, but both pupils reacted to light there was no deviation nor nystagmus. There was no motor paralysis. Abdominal and cremasteric reflexes were present and equal. There was no Babinski Oppenheim or clonus. The fundus of the eye showed no injury or edema. The x ray showed no evidence of fracture. Lumbar puncture showed spinal fluid slightly tinged with blood. The blood-pressure was 120 The pulse varied from 45 to 60. It was a question whether operation should be done or not. On the next day the patient was quieter and clearer although still confused the pulse was unchanged. It then appeared that the patient, a physician's son, always did have a slow pulse. The patient steadily improved mentally blood-pressure did not increase. On the seventh day the patient was oriented and clear mentally. Ear consultation on the second day showed 'fracture of the posterior wall of the auditory canal. No paralysis developed. Today the patient is perfectly clear reads the newspaper with understanding has no abnormal reflexes, and is almost ready for discharge. (Was discharged on the fourteenth day and has shown no abnormal symptoms since.) The temperature was elevated for the first six days (never over 100° F) came to normal on the ninth day the pulse was 80 on the tenth day.

With this patient the question of operation was considered daily for seven days. There was at no time any symptom of focal injury. It was believed that the blood in the spinal fluid indicated intracranial hemorrhage, but in the absence of evidence of severe pressure it did not seem clear that decompression was indicated although the long-continued mental confusion seemed to indicate moderate edema, but that edema constantly improved. Had a decompression been done the recovery might have been assigned to the decompression. It is to be remembered always that the symptomatology of brain injury however is not exact, as will be shown by the next case.

Case IX.—M C female single housewife. Ten days before

On opening the dura the brain was found under marked pressure with very slight pulsation, and a marked subpial hemorrhage. The sinus hemorrhage was checked by packing with gauze strips. The patient was restless and irrational that night. The unilateral paralysis continued. The next morning the patient had a muttering delirium, like the delirium of D. T. The next day the patient was clearer and the pulse, which had been about 100, came down to 80. In an attempt to remove some of the gauze wicks the hemorrhage began again, and packing had to be continued. The pulse rose to 140 and the patient died. In this case the death was due to pressure caused by intracranial hemorrhage.

LACERATION OF THE BRAIN

In the cases shown so far it is clear that the brain injury may be the result of violence which causes edema without fracture, or edema accompanied by fracture, which may be simple or compound. Certain injuries may show in addition to the edema, an actual laceration of the brain, slight or extensive. These cases of laceration also may be accompanied by fracture and these fractures again may be simple or compound.

The laceration may be slight or severe may vary from punctate hemorrhage to extensive and often fatal crushes. These lesions may be diametrically opposite the point of application of the violence so that the injury may be produced by what is called "contrecoup." A comparatively slight case of laceration may be seen in the patient next presented, twelve days subsequent to his injury.

During the past year the following cases in which a diagnosis of laceration was made were treated

	Number	Well	Operated	Died	Operated—death
Simple...	18	7	1	11	1
Compound	8	1	1	7	1

CASE VIII.—J. R. H. twenty-two male single, student. While riding a motor cycle on a muddy street the machine skidded and the patient was thrown, and is said by spectators to have struck on his head. He was at once brought to the hospital in a

	Number.	Wet.	Operated.	Died.	Operated—died.
Simple	4	2	3	2	1
Compound	1	2	2	0	0

The last case reported today gives a classical series of symptoms, and illustrates the brilliant results often obtained by surgical treatment.

Case X—A. K. D. twenty male single, college student. October 20 1914 patient was hit in left parietal region by a batted baseball at 3.30 P. M. The blow dazed him, but he was not unconscious. At 4 P. M. the patient walked to his room about half a mile away alone. At 5.30 P. M. a roommate found him conscious, but able to talk with difficulty. At 6 P. M. he was sent to the infirmary by a physician. At 6.30 P. M. he became profoundly unconscious. At that time temperature was 98.6° F. pulse 48. He could hardly be roused. He did not move his right arm or leg and there was slight twitching of the right side of his face. There was a right Babinski. The patient vomited twice and after vomiting pulse rose to 70. Pupils were moderate in size equal, and reacted. The fundi were normal. All right reflexes were more active than left. There was right ankle-clonus. Babinski and Oppenheim right, none on the left. An immediate left-sided osteoplastic decompression was done and showed a large extradural clot about 8 ounces, with active hemorrhage from the middle meningeal artery checked by gauze packing as the vessel could not be tied. At the end of forty eight hours improvement was great, no paralysis, no headache no difficulty in talking normal reflexes, and he could read. At the end of eighteen days he was up and about, no paralysis and no aphasia. By December 2d he was back in college, doing college work. In February he passed all his examinations, and in June was graduated with his class (1916). He was later commissioned a Lieutenant in the A. E. F. and at that time the examining physician observed no defect in the skull. An x ray taken at Camp Devens in June 1918 showed that the bone defect was completely closed by bony tissue. The patient, most unfortunately was killed in France in the summer of 1918.

These cases have been classified under five headings but it

admission the patient was drunk and fell down stairs, but was not made unconscious. She complained afterward of severe headache but there was no paralysis. The day before admission she walked to another hospital, the head was x rayed but no fracture was found. That night she became unconscious, and the next day she was brought to the hospital in the police ambulance. On admission she was unconscious. There was a hematoma over the right parietal region. There was no paralysis. The right pupil was greater than the left and neither reacted. Knee-jerks were absent. There was a double Babinski, Oppenheim, and ankle-clonus. An immediate right-sided osteoplastic decompression was done. There was found a linear fracture through the right parietal bone, with neither separation nor depression. The brain did not pulsate. There was a thin film of blood-clot in the parietal region beneath the dura, but no sign of fresh hemorrhage. The patient left the table in fair condition, but died in ten hours. A medicolegal autopsy showed multiple fractures through the temporosphenoidal bones. Both temporal lobes showed very extensive destruction, with infiltration with blood, with marked softening of those areas. The area involved was on each side about 10 by 6 cm. and about 2 cm. deep. All sinuses both middle meningeal arteries, and all basal vessels were intact. The temperature on admission was 102.5° F.

The notable features of this case were the extensive destruction, which however caused no focal symptoms, and the elevated temperature, which is constant in these cases of brain laceration.

INTRACRANIAL HEMORRHAGE

In addition to the cases of edema, with or without fracture, and of laceration, with or without fracture there is still another type of intracranial injury which is common, fatal if unrecognized and unrelieved, and which again may be accompanied with fracture either simple or compound. In this class are included all cases of intracranial hemorrhage from arteries or from sinuses. These hemorrhages may be extradural or intracerebral.

During the past year the following cases of intracranial hemorrhage have been treated at the hospital

The results of brain laceration are serious, often fatal. The recognition of these cases is not always simple, often being confused with severe concussion (edema). The pathologic con



Fig. 250.—Photograph of base of brain. Severe laceration. Patient struck by motor. Brought to the hospital semiconscious, lived four days. No obvious change of symptoms. Visible injury over vertex; the serious injury of brain is right temporal and both frontal regions (contrecoup). Edema symptoms never marked. Futility of operation obvious.

dition cannot always be determined with accuracy (cf. Case IX). The hemorrhages vary from minute petechiae to very extensive smashing and crushing and the location of the laceration may be

will be seen that there are but three classes of injury to the brain—edema laceration and hemorrhage. The injury of the cranium is of very little consequence. In many instances except for the x-ray it would be impossible to detect the injury of the skull in some cases there is no evidence of any brain injury. It undoubtedly often is true that fracture of the skull exists in cases considered to be contusion only. In some cases the fracture may cause a secondary rupture either of an artery (middle meningeal) or of a brain sinus. In these instances the hemorrhage may produce secondary cerebral pressure and demand an operation, but the operation is for the relief of the hemorrhage and, naturally is not for the fracture. Edema with its resulting increase of intracranial pressure is the most common cause of brain symptoms. Edema alone is present in nearly all cases of concussion, and as the cases and figures show nearly all recover spontaneously. In edema alone the spinal fluid is clear not bloody and one most informing symptom—the temperature in these cases remains low. In cases of pure edema operation very rarely is called for. Rarely the edema is so extreme as to demand operation for relief of pressure. In a few cases a persistence of or increased pressure, with persisting mental confusion made a decompression operation desirable, but these cases are rare, and improving cases almost never should be operated. The presence or absence of a fracture has but little effect upon the decision as to the desirability of operation except in cases of depressed fracture.

Practically all cases of depressed fracture should be operated on. In many cases of depression the accompanying pressure (edema) demands immediate relief, whether the fracture is simple or compound. In many cases the immediate pressure is so great as to demand immediate relief, in other cases the pressure of the depressed bone may not be severe, but the depression should be elevated, because otherwise months or even years after the injury cysts or areas of sclerosis or areas of softening may occur and cause serious focal symptoms or spasms, and the results of later operations are much less satisfactory than is the case in early operation.

temperature will rise and remain high (101° F or more). In both edema and laceration the pressure of the spinal fluid may

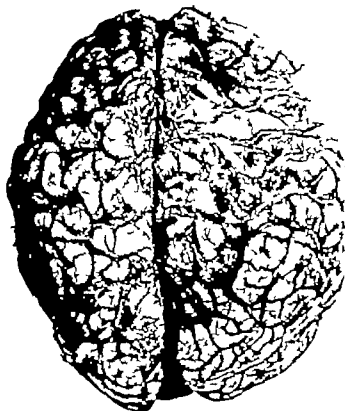


Fig. 232.—Photograph of upper surface of brain. Injury due to fall or blow. Young man with history of fall in the street. Marked depression over left posterior parietal region, due to extradural hemorrhage. No blood in spinal fluid. Flattening of left parietal region evident. Death in twenty hours.

be high. The most difficult decision as regards operation is between cases of moderate laceration with but little blood in the spinal fluid and severe edema. Many if not most cases of

diametrically opposite the point of application of the primary force (contrecoup). The cases of laceration are nearly always accompanied with marked edema. The determination of lacera-



Fig. 231.—Photograph of base of brain. Patient fell down stairs. External injury over back of head, brain injury in both temporal and frontal regions (contrecoup). Edema not marked at any time. Gross destruction of brain, and uselessness of decompression evident.

tion is best made by spinal tapping. In pure edema the fluid will be clear and the temperature will be low. In laceration the spinal fluid will be blood tinged and within twenty-four hours the

should be treated like all wounds of compound fracture ; & they should be rendered as sterile as possible

CONCLUSIONS

1 Very few cases of edema demand operation and then only when there is a constant rise in blood-pressure.

2 Operation upon extensive laceration offers little hope. It should be done only when edema is so extreme as to demand relief of pressure

3 All cases of hemorrhage should be operated at once.

4. All cases with definite focal symptoms should be operated at once they generally represent hemorrhage.

5 Dilated and fixed pupils are almost always a positive contraindication for operation.

6 One observation of high blood-pressure is of little value. Continued high blood-pressure with a depressed pulse is a strong indication for operation.

7 High pressure of the spinal fluid, as shown by the manometer reading is of greater value than high blood-pressure as an indication for operation.

laceration die, most cases of edema recover without operation—It is not always possible to differentiate

All cases of hemorrhage should be operated at once the diagnosis is made. It is not always easy to decide between laceration and hemorrhage, or even edema and hemorrhage. In subdural hemorrhage, as in laceration, there will be blood in the spinal fluid edema may be present in both. But in the classical subdural hemorrhage (see Case V.) there comes, first, unconsciousness or confusion, often temporary (result of edema) soon followed by consciousness (relief of edema) again followed after a variable period (thirty minutes to twenty-four hours—apparently dependent upon the site of hemorrhage) by unconsciousness, perhaps preceded by a short period of cerebral irritations (convulsions or spasms or increased reflexes) The second period of unconsciousness is due to increased intracranial pressure caused by hemorrhage. These cases all should be operated. Also in these cases there almost always are focal symptoms indicating the place of the hemorrhage

In extradural hemorrhage it may be difficult to distinguish the lesion from a case of severe edema. In some cases of edema (cf. Case II) there may be focal symptoms. In some cases of extradural hemorrhage there will be a clear spinal fluid with focal symptoms. It may be impossible to distinguish such a case from edema. One thing is clear however that in all cases of evident focal symptoms operation is indicated.

One fact is evident. In all cases of injury to the head, accompanied by cerebral confusion, even if temporary the patient should be kept under observation for at least a full twenty-four hours. If at the end of that time the patient is clear mentally and shows no parents or focal symptoms, it may be fairly concluded that the danger period is past, as it is exceedingly unusual for hemorrhage to develop after that time. Before that time all head injuries carry the possibility of serious hemorrhage.

Just one other final warning. In practically all fractures of the base of the skull the fractures are nearly all compound therefore all compound wounds (bleeding from the ears, etc.)

CLINIC OF DR. WILLIAM P GRAVES

GIVEN BEFORE THE BOSTON SURGICAL SOCIETY AT THE FREE
HOSPITAL FOR WOMEN

MULTIPLE POSTPERITONEAL CYSTOMATA. ARTIFICIAL VAGINA. MENSTRUATIO PRÆCOX. RADIUM IN THE TREATMENT OF CERVICAL CANCER. RADIUM IN THE TREATMENT OF MENORRHAGIA OF THE YOUNG

GENTLEMEN I shall first demonstrate 3 cases from the hospital wards which present points of especial gynecologic interest, and then take up the subject of the use of radium in the treatment both of uterine cancer and of non-malignant uterine bleeding

The first of the ward cases is one of multiple postperitoneal cystomata.

MULTIPLE POSTPERITONEAL CYSTOMATA

This patient is forty-five years old the mother of 3 children. For four years she has noticed a lump in the right lower quadrant, which has appeared noticeably larger at the time of her monthly periods. There has been no pain until about four weeks before entering the hospital during which time there was a constant sense of discomfort, with dull pain extending to the vagina. This was accompanied by sacral backache, frequency of urination, and dyspnea on exertion. Vaginal examination revealed a large tense tumor the lower segment of which was packed in the true pelvis. The cervical os could just be palpated far up under the pubes. The diagnosis made by the consulting physician and by myself was that of a fibroid uterus, possibly in the nature of a cervical myoma. At operation, performed thirteen days ago, the uterus was found studded with small fibroids and pushed high

was clamped and cut in the manner employed for the removal of a pedunculated ovarian cyst. In finishing the operation it was found that in the clamp which held the last pedicle of tissue was contained a loop of the external iliac vein which had been completely severed an accident that necessitated the tying of the vein. The vessel had been widely displaced by the growth of the tumor but its injury might have been easily avoided by a stricter adherence to the principles of technic above described. Fortunately the tying of the vein did no harm to the patient.

The case has a further interest in that after the pelvic operation including a hysterectomy had been finished, another post peritoneal cyst of considerable size was discovered lying behind the descending colon, and included between the peritoneal leaves of the mesentery. The mesenteric vessels were greatly distended and apparently closely adherent to the tumor. The problem of removing this second tumor without injuring the superjacent blood-vessels was, of course, one of much greater importance than in the first operation, on account of the necessity of preserving the integrity of the circulation of the gut. An incision was made through the outer peritoneal leaf of the mesentery the proper plane of cleavage was found and the tumor was excised entirely with the hand.

I should like to call your attention to the abdominal wound in this case. You will note that an incision had been made at right angles to the median incision and directly across the left rectus muscle. This maneuver is one of much value when, during an exploratory operation through the median line it becomes necessary to remove a lateral-lying growth. The repair of the severed rectus muscle-fibers is easily accomplished, and in my experience there has been no tendency to later hernia.

With your permission I will say a few words regarding the histogenesis of the postperitoneal tumors. They appear in a great variety of forms, including fibroma, fibrosarcoma, lipoma, simple serous cystoma, multilocular serous cystadenoma, teratoma, dermoid cystoma, etc. One may readily imagine that such tumors as the fibromata and lipomata have their origin in the subperitoneal cellular tissue in a manner entirely analogous

up in the lower abdominal cavity by a cystic tumor lying behind the peritoneum and greatly displacing the rectum toward the right. There was no connection between the tumor and the adnexa of the uterus. Spread out over the tumor were large flattened veins.

The removal of these large postperitoneal growths should occasion no great difficulty if certain important surgical principles are conscientiously adhered to. In the first place, it must be remembered that they have no definite vascular pedicles and that they derive their nourishment from the capillaries of the surrounding tissues. The great sinister-looking veins that appear on the surface are not incorporated in the true wall of the cyst, but are merely peritoneal veins congested and distended by pressure. They lie therefore, in planes external to the wall of the tumor. This characteristic gives a clue to the proper technic of removal. An incision is made through the peritoneal covering as far away as possible from the overlying veins. The peritoneal layer is delicately lifted until a plane of cleavage is attained which will admit of inserting the hand between the tumor wall and the peritoneal covering. The process of cleavage is then carried on around the tumor keeping *below* the plane of tissue which contains the large veins. When resistance to this process is met with, the temptation to cut must be resisted and further progress be made by seeking a deeper plain of cleavage, *that is to say one that is closer to the wall of the cyst.* It is always important to avoid rupturing the cyst, for once it is collapsed the difficulties of its removal without causing hemorrhage and tearing of the surrounding tissues are greatly increased. When the wall of the cyst is thin or necrotic, the sounder portions should be enucleated first, so that if rupture is inevitable it may be postponed until the tumor shall have been for the most part delivered. In this way the operation may almost entirely be completed by the fingers and open hand.

In the case before you the technic just described was carried out properly until the last few shreds of adherent tissue were reached. A necrotic portion of the cyst had just been ruptured and in the general m \acute{e} tie that followed the adherent strip of tissue

following may be a rational explanation of the histogenesis of some of the postperitoneal tumors

If the embryonic peritoneum has the power of a local differentiation into the germinal epithelium which in turn may produce germ-cells, it is entirely conceivable that this power of differentiation may abnormally appear in parts of the peritoneum other than in that portion which is eventually destined to become a genital gland. In this way cells may be created in different areas of the subperitoneal space exactly similar to those in the ovary which have the power of becoming dermoids or teratomata.

The theory of abnormal differentiation of the peritoneum into germinal epithelium is substantiated by the pathologic finding of the tumors removed from the patient before you. The larger tumor from the pelvis proved to be a multilocular papillary adenocystoma, exactly like the ordinary ovarian type. The tumor from the upper abdomen was of the same nature, though it showed a less advanced development in that the lining cells were non-papillary and had the characteristics of germinal epithelium. It would seem that in this case the peritoneum in two abnormal locations assumed the type of germinal epithelium and had been the source of two tumors which can in no way be distinguished microscopically from ovarian cyst adenomata.

I am at present preparing a paper which will more fully expound this theory.

The second case to be shown is one which illustrates a method of constructing an artificial vagina.

METHOD OF CONSTRUCTING AN ARTIFICIAL VAGINA

This patient is twenty years old and has been married for a year. She has never menstruated. She was brought to the hospital by her husband on account of the impossibility of coitus. Examination showed a typical condition of congenital absence of vagina. The external genitals were moderately well developed and the secondary sexual characteristics were within the range of normality though somewhat meager.

to that which they exhibit in any other part of the body. The unusually large size that they may attain postperitoneally is doubtless due to the slight tissue resistance that they encounter during their growth. One may also imagine that some of the simple serous cysts may arise from isolated rests of the wolffian ducts.

The histogenesis of certain of the growths is, however, not as easily explained. Especially is this true of the dermoids and teratomata. These tumors, whether they originate in the ovaries or postperitoneally are unquestionably ovigenous. Their development in the postperitoneal cellular tissue has been usually attributed to misplaced blastomeres that, after the original segmentation, have wandered away from their normal place of assembly in the genital gland and have become isolated at some point in the postperitoneal space. The acceptance of this explanation implies a belief in the germ-plasm theory of Weismann, which asserts that the germ-cells (ova and spermatozoa) are entirely independent in their relation to the body or somatic cells, both in origin and growth. Recent studies in the embryologic development of the germinal epithelium covering the ovary have done much to disprove this theory. Thus it has been shown that the genital gland originally develops from the germinal epithelium, which is itself a local modification of the peritoneum. The growth in size of the genital gland is due to an invasion downward of the germinal epithelium and it has been shown that all the cellular elements of the ovary with the exception of a fine connective-tissue framework are derived from the down-growing germinal epithelium. These cellular structures include the stroma, interstitial cells, the remains of the rete ovarii, and cords of Pflüger, the granulosa layer of the graafian follicles, and finally *the ova themselves*. It may be seen, therefore that the ovarian dermoids and teratomata being ovigenous, are derived in the last analysis from the germinal epithelium. It has also been conclusively proved that the serous cystadenomata are derived directly from the germinal epithelial layer that invests the ovary.

Bearing these facts in mind, it has seemed to me that the

form such as is used for maintaining a dilatation of the vagina is placed at the artificial opening but pointing *outward* the five or six skin flaps are then sewed together over the glass form the flaps being turned so that the skin surfaces face externally. Great care should be taken to secure accurate coaptation of the skin edges, and to fit the cap of skin smoothly over the glass form. When the sewing of the skin flaps has been nearly completed the ends of the sutures that had been attached to the vault of the artificial pouch are now brought out threaded into needles, and passed through the dome of the cap made up of skin flaps. By carefully inverting the cap the artificial pouch becomes lined with a layer of skin which may be fastened snugly in place by tying the sutures that had been placed in the vault. The final step in the operation is to close with fine catgut sutures the remaining openings in the skin flaps at the introitus.

The patient before you was operated on about six weeks ago. If you will examine her you will find that the skin lining the new vagina has already become modified in character so that it is now soft and moist and devoid of hairs.

Although I have never attempted the so-called Baldwin operation of bringing down a loop of gut into the artificial opening made between bladder and rectum I am convinced that it has no advantages over the procedure that I have just described. It certainly subjects the patient to a far greater operative risk. Moreover the disadvantages of a vaginal lining composed of such a secreting and absorbing surface as the intestinal mucous membrane more than outbalances the slightly greater depth of the vaginal pouch that the operation may attain.

The patient upon whom I first operated was married soon afterward. That the operation was successful is attested by the fact that ten years later the husband called on me to express his gratitude and satisfaction for what had been done for his wife.

Congenital absence of the vagina is not a very rare defect. During my service at the Free Hospital we have seen, including the present one, 5 cases. The defect appears to represent an arrested development of the lower segments of the Müllerian ducts. It was formerly believed that many of these patients

The situation was explained to the husband, an intelligent Italian laborer who earnestly requested an operation.

There are two methods that may be chosen for constructing an artificial vagina. The first is a plastic operation, by which skin-flaps are turned into an opening made between the bladder and rectum. The second method consists in employing a loop of bowel which has been *resected without disturbing its blood-supply*. In this case the first method was used. I had performed this operation once before in 1908 on a similar case, and at that time devised a special technic which was later published. The steps of the operation are as follows. A transverse incision, about 2 inches in length, is made across the space usually occupied by the introitus. With blunt dissection a plane of cleavage is sought beginning just above the commissure of the levator ani muscles. It will be found that the tissues may be separated with comparative ease. Some bleeding is encountered so that it is necessary to proceed cautiously with the separation. In this way an opening is made which corresponds in its proportions to a normal vagina. It is important not to enter the abdominal cavity. Several catgut sutures with long ends are placed in the vault of the new opening and the ends tucked into the pouch for later use, as will be described. The second part of the operation is to line the opening thus formed with skin turned in from the surrounding parts. This may best be accomplished in the following manner. The labia minora are first partially amputated the incisions beginning near the clitoris and continued downward toward the artificial opening, but leaving sufficient pedicle to allow competent circulation. The skin layers of the partially amputated labia are then separated so that they appear as two paddle-shaped flaps. Two similar flaps are then dissected from the thighs. A third and if need be a fourth may be taken from the buttocks, as shown in the drawing. In outlining the skin-flaps it is important to mark the pedicles of the paddle-shaped areas in a *curved* direction. By observing this rule the flaps may be turned face outward without causing disagreeable folds at their attachments near the artificial opening. The skin wounds made by the removal of the flaps having been sewed, a glass

occurred a little over three weeks ago. This history has been verified by the patient's mother and older sister.

It seems evident that the menstrual precocity in this case was due to some minor functional activity of the glands of internal secretion. One would expect from so extraordinary a history to find some associated disease of the pineal, or pituitary or thymus gland but there is no evidence either in the patient's history or in her present appearance of such abnormality. Judging from the mother's story it is probable that the development of puberty did not take place until the age of ten. The infantile menstruation, therefore, could not have been of very profound significance. Precocious menstruation of the ordinary type is usually an inherited peculiarity. In this case it is interesting to note that the mother menstruated at the age of eleven, and that the older sister reached puberty at the age of nine. Inquiry of the mother as to the patient's early mentality reveals that she was somewhat above the average in intelligence. She has during her life exhibited exceptional musical talent, and is distinguished among her friends for her entertaining wit.

There may be some etiologic relationship between this patient's menstrual history and the large fibroid that was removed at operation. It has been a matter of personal observation corroborated in the literature that patients who have had an early puberty are especially prone to fibroids later in life.

RADIUM IN THE TREATMENT OF INOPERABLE CANCER OF THE CERVIX

We will now turn our attention to some radium cases, and I shall first show a few patients who have been treated for cancer of the cervix uteri. These cases are not presented as brilliant successes of the radium treatment, but only to demonstrate the average results attained by the application of radium to advanced cervical cancer.

I should preface my remarks on these cases by saying that we are at present treating only those patients in whom the disease is definitely inoperable. It should be added also that

were without ovaries because frequently the glands could not be palpated by rectal examination. This was undoubtedly an erroneous conclusion. In 4 of our cases the external genitals and secondary sexual characteristics were normally developed, and in 1 case the patient was an unusually fine physical specimen of womanhood. One of the 5 cases was a girl under twenty years of age, who showed evidence of a deficient general development. She applied for relief from severe hot flushes. An operation for castration was advised and willingly submitted to by the patient. At operation two fully developed ovaries were found lying well above the brim of the pelvis, thus accounting for the fact that they could not be palpated by rectum. Both fallopian tubes were completely developed, but the uterus was very rudimentary being not much larger than a pea. A fine solid strand of tissue descending for a short distance below the uterus represented the rudiments of the vagina. Removal of the ovaries produced a complete relief of symptoms.

The next patient to be shown is another gynecologic curiosity from the fact that she gives an unusual history of menstruation *præcox*.

MENSTRUATIO PRÆCOX

This patient is thirty-seven years of age, married sixteen years, and the mother of 2 children. For eight years she has noticed a gradually increasing lump in the lower abdomen. During this time she has had occasional attacks of abdominal pain, chiefly at the time of her periods. At the time of entrance into the hospital she presented a condition of rather marked anemia, the hemoglobin being 45 per cent. although there had been no excessive loss of blood. At the operation, which was performed eleven days ago a large, very adherent fibroid uterus was removed. The convalescence has been uneventful.

The patient states that she was born menstruating, and that until she was eight years old she had a slight bloody discharge each month. The menstruation then ceased for two years, but reappeared at the age of ten, and has continued at normal intervals and in normal quantity until her last period, which

occurred a little over three weeks ago. This history has been verified by the patient's mother and older sister.

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medical community to establish radium plants with the best facilities for its application.

The first patient in our cancer series is fifty-one years old. For ten months previous to her entrance into the hospital she had almost constant flowing with severe continuous pain in the back extending downward into the thighs. Examination showed inoperable cancer of the cervix. On October 21 1920 100 milligrams of radium were applied for twenty four hours. The patient now reports for the first time. There has been no flowing since the treatment and there has been considerable though not complete relief from pain. Vaginal examination shows no great change in the feeling or the appearance of the cancer mass. This was a hopeless case from the start, especially as her symptoms indicated metastatic involvement of the regional lymph-glands. The radium, however has distinctly relieved the patient's sufferings.

The next patient is fifty three years old. For several months before consultation she had had intermittent flowing foul discharge, and pain in the back and thighs. An ether examination was made June 1 1920 to determine the possibility of operating. It was found that the patient had an inverting cancer of the cervix, extending into the parametria. Operation was not feasible. Radium was applied to the internal and external portions of the cervix.

The patient reported on November 22d saying that she had had complete relief of symptoms, including the bleeding vaginal discharge, and pain in the back. At that time under ether no recurrence could be felt by vaginal or rectal examination.

She now reports again. She has had a little blood in the stools. Vaginal examination, as you will see reveals a suspicious hardness around the cervix, while by rectal palpation a dense bridge of tissue can be felt just posterior to the cervix. I have no doubt that the progress of the disease is asserting itself.

The next patient is sixty years old. She entered the hospital on June 17 1920. She had had symptoms of bleeding for eight months but there had been no characteristic pain. Examination revealed an inoperable cancer of the cervix to which radium was

since the advent of radium our definition of what is operable and what is inoperable in cervical cancer has undergone some modification. Formerly we regarded as operable a case of cancer wherein it appeared possible to perform a radical operation without killing the patient or without mutilating the hollow organs of the pelvis, even though it seemed probable that a permanent cure of the disease could not be effected. This policy was pursued because such operations usually palliated the patient's symptoms and often greatly prolonged her life. Since the acquisition of radium, we have come to define as operable only those cases in which a radical operation offers some chance of attaining a permanent cure. We have reached this viewpoint because we have found that in these sub-borderline cases radium sometimes, though not always, produces palliative results equal to those of radical operation, and does not subject the patient to operative risk.

We have not yet become convinced that in an operable case (or perhaps one should say a curable case) we are giving the patient as good a chance for ultimate cure by radium as we are by operation. This, however it must be remembered is an individual standard, which may not be applicable in other clinics. Thus when confronted with an operable case we have to decide between a rather long operative experience and a somewhat inadequate radium equipment as our two weapons for combating the disease, and up to the present time we have regarded the former as more reliable. Our radium outfit consists only of 100 milligrams in the form of salts, divided into three portions. Although this amount has been of inestimable benefit as a palliative agent, it has not infrequently proved unreliable and treacherous. I am entirely convinced that this equipment is too meagre and the possibilities of effective application too clumsy to warrant its use in the treatment of a frankly operable case. We are therefore waiting with the keenest interest detailed time-reports from those institutions in which cancer of the cervix is being treated with large doses of radium in the form of emanations. If the results from these experimental institutions turn out to be as favorable as they at present give promise of being it will be the duty of every hospital or at least of every

had been wearing a pessary for general prolapse. An extremely ill-fitting hard rubber pessary was removed from the vagina. The pessary was not only too large for the vagina, but it had been inserted upside down so that undue pressure was exerted on the lateral walls of the vagina near the orifice. Examination showed on each side of the vagina just within the introitus, an irregular hard infiltrating mass, which microscopic examination of an excised specimen proved to be an epithelioma of an early cancerous type. On account of the position of the two masses and their bilateral symmetric nature it seemed probable that they had been stimulated to growth by the pressure of the pessary. As operation would entail serious technical difficulties, it was deemed an excellent opportunity to test the power of radium on an early cancerous growth. Accordingly the two masses were treated separately one month apart. At the time of the second application the mass that had first been treated had completely disappeared. The patient was not seen again until last November. For a month she had been suffering severe pain in the vagina, with some foul discharge and blood. Examination showed no trace of the mass first treated, but on the other side there was a large indurated ulcer with a deep infiltration of extreme hardness, extending back toward the ischiadic region. The floor of the ulcer was covered with the dense white tenacious membrane that is often seen in tissues that have been subjected to radiation. Although the feel and appearance suggested a rapid invasion of the original disease, sections from the edge of the ulcer showed under the microscope only chronic granulation tissue. It seemed probable, therefore, that the ulceration was the result of an extensive radium burn, and that the dense induration surrounding it was merely an intensification of the usual sclerotic tissue reaction which radium always produces. Various local applications had no effect whatever on the condition. Finally under ether the ulcer was deeply and extensively excoriated with an actual cautery at white heat. Since then the improvement in the diseased area has been remarkable. At the present time as you may see by examining the patient, only a small part of the induration remains, and

applied. She now reports that since her treatment in June there has been no bleeding discharge, or pain. If you will examine her you will find that the cervix cannot be felt and that the upper vagina is completely closed. No evidence of the disease can be felt by vaginal or rectal examination. The patient feels and appears in perfect health.

The case at the present moment seems to represent a cure, but numerous disappointments in the past lead me to believe that the disease is only temporarily arrested and that it will eventually make a reappearance, even though it may not be for many months.

The next patient is fifty four years old. In November 1918 I performed a radical operation for squamous cancer of the cervix. In September 1919 I made a mild application of radium to the vault of the amputated vagina on account of a slight suspicion of a local recurrence. In April, 1920 seven months later the patient developed a small vesicovaginal fistula. This fistula was closed by operation, but macroscopic examination of the pieces of vaginal membrane removed from about the opening showed cancer. Three months later the fistula opened again and has remained open since, gradually becoming larger.

The patient still looks and feels well having actually gained in weight during the past six months. Examination, however shows increasing induration of the vault of the vagina with the characteristic hard bridge of tissue around the anterior wall of the rectum. The fistula can be felt passing through the dense unyielding vaginal vault.

This case illustrates very well the ease with which a fistula may be produced by radium especially after a complete hysterectomy has been performed. It is one of several similar cases that have made me wary of using radium as a prophylactic measure following radical operation.

The next case is one that does not properly belong to this series of cervical cancer but is introduced as it exhibits certain points of especial interest. The patient is sixty-four years of age. She entered the hospital in May 1920, with history of foul discharge with occasional bleeding. For two years she

the menopause. Operators were fearful of using it in young women on account of the danger of bringing about an artificial menopause. It was soon discovered that when radium is given in moderate dosage excessive menstruation may be diminished and regulated with a fair degree of certainty. At the present time it is employed without hesitation for urgent cases even in pubescent girls. The question of whether radium destroys fertility even though it does not stop menstruation is only recently being answered. The cases that I have to show you will throw some light on this important subject.

The first patient is now twenty-six years of age and single. You will notice that she has excellent color and in every way gives an impression of rugged health. She came to the hospital a little more than three years ago. She stated that she had begun to menstruate at the age of thirteen. For the first three months the menses had been regular and normal in amount. They then became increasingly irregular and frequent, until she flowed almost continuously a condition which had been maintained for nearly six years. At the time of entrance in the hospital she was using from one to three napkins daily. The patient was extremely pale and weak. Examination of the blood showed a hemoglobin of 40 per cent.

On September 25 1917 she was cureteted for diagnosis microscopic examination of the curetings revealing a permanent gland hypertrophy. 50 milligrams of radium were applied to the uterine cavity for six hours. The patient with her mother reported to me personally during the following January. With the exception of a slight show in October there had been no appearance of blood since the operation. The patient had regained her color and was feeling in perfect health. The mother however was greatly distressed at the disappearance of menstruation and was slightly threatening in her attitude. A course of ovarian feeding was instituted in the form of whole ovary capsules 5 grains three times daily. Menstruation soon appeared and has continued ever since though with considerable irregularity. In general there has been a scanty flow for two days, at about two weeks intervals. On five occasions during

the ulcer is nearly healed over. The final outcome of this case will be a matter of intense interest.

RADIUM IN THE TREATMENT OF NON-MALIGNANT MENORRHAGIA

We shall now consider a series of cases that have been treated with radium for uterine bleeding from non-malignant causes. I have chosen for this series a set of cases that illustrate a particular phase of the subject, namely the *menorrhagias* and *metrorrhagias* of girls and young women with special reference to the question of the preservation of menstruation and fertility. The value of radium in the treatment of the uterine insufficiency of middle age is so well established and so well known to you that I shall omit altogether that part of the subject from my discussion.

Before the advent of radium uterine bleeding in adolescence and young womanhood presented a baffling problem. The etiology of this condition has never been solved. In a few of our cases we could trace it with a fair degree of certainty to an habitual supersexuality that kept the genital organs in a constant state of congestion. In three or four other cases a positive Wassermann reaction was discovered. But, as a rule, no tangible etiologic factor could be discovered. One may speak of ovarian hyperfunction as a cause, but the term is based on the vaguest kind of knowledge, and even if it is correctly used it is of no assistance in the problem of treatment. The various remedies for this condition such as animal serums, gland extracts, like pituitrin, the various styptics, iron, arsenic, etc. are all of very equivocal value. Repeated curettings are equally useless. The bleeding not infrequently continues for years, and may reduce the patient to an extreme state of anemia. It may even result fatally. One patient who had been bleeding in this way for several years was brought to the hospital, almost completely exsanguinated, and died before we were able to help her. In a number of our cases we were obliged to resort to hysterectomy and castration.

In the earlier days of radium as a therapeutic agent it was applied only for the *menorrhagias* of women comparatively near

ovaries of older women, as will be explained in the discussion of the next case. Nevertheless the matter of dosage is still very much in the experimental stage, and it is necessary to recommend the greatest caution, especially in the treatment of the young. An operator who by the reckless use of radium should bring about an artificial menopause in a patient like the one before you would lay himself open to the severest criticism.

The last case is perhaps the most important one of the series in that it serves to answer the often repeated question regarding the influence of radiation on fertility.

I first saw this patient in the spring of 1917 when she was twenty three years old and single. At that time I operated on her for ante flexion and dysmenorrhea. The operation consisted of an Olshausen suspension of the uterus, combined with lysis of adhesions to an old appendix scar. She appeared again two years later seven months after her marriage. She had a miscarriage two months after marriage, and had been flowing profusely ever since. A curetment was performed, the curetings showing a chronic cystic dilatation of the endometrial glands. This operation brought her no relief and she again entered the hospital two months later having flowed almost continuously and requiring seven or eight napkins daily. Radium was advised and accepted. At operation the same condition, gland hypertrophy of the endometrium, was discovered. 50 milligrams of radium were applied to the uterine canal for twelve hours, the patient having been warned beforehand that this dosage might produce an artificial menopause. The patient did not menstruate for four months, after which time the menses became regularly established. If you will examine her you will see that she is now three months pregnant.

You may perhaps be interested in a brief description of the theory regarding the action of radium on the pelvic organs when applied for the purpose of stopping or regulating uterine hemorrhage.

It seems probable that the rays exert an influence both on the endometrium and on the graafian follicles of the ovaries. The exact effect on the endometrium has not been determined since

the last three years there has been a smart flowing spell lasting for two or three hours.

From a physiologic standpoint the result of the single radium treatment cannot be regarded as perfect, in that an entirely normal menstrual rhythm has not been established. Nevertheless, from the standpoint of the patient's health and well-being it is extremely satisfactory.

The next case illustrates well the value of radium in treating the uncontrollable hemorrhages of puberty. This patient came to the hospital three years ago at the age of thirteen. Menstruation had started five months before and had continued almost without cessation. The patient was in a much depleted condition. Realizing the futility of drugs and curetting, I decided to try a small dose of radium, although we had not before treated so young a patient, nor could I at that time find anything definite in the literature bearing on the subject. Accordingly 25 milligrams of radium were applied in the uterus for six hours. The pelvic organs were normal. A specimen of the endometrium removed for macroscopic examination showed permanent gland hypertrophy—a condition that one usually finds in young menorrhagic patients.

Bleeding ceased after the operation, and two weeks later a normal, rather scanty catamenia took place, lasting about six days. Since that time the periods have come at regular six week intervals lasting five to six days, and requiring an average of two napkins each day. The patient is now sixteen years old and is in excellent health. In making a decision as to the treatment of a very young patient, the question of the danger of causing a complete cessation of the menses has been a most important one. Emboldened by the success of this case I have since treated a number of patients of the same type, and have become convinced that a dosage of 25 milligrams for four to six hours may be given with entire safety. There have been two cases of recurrence of abnormal bleeding where I have used the same amount of radium for only two hours. It is quite probable that the ovaries of the young are able to withstand greater exposure to radiation without losing their function than are the

abnormal bleeding which before characterized it may be explained by some minute but permanent change in the endometrium.

As I mentioned before, it seems evident that the menstrual function is more resistant in young women. Thus in the uterine insufficiencies near the menopause a dosage of 50 milligrams for twelve hours is enough to stop the menstruation entirely whereas in this last case that I have just shown you the menses were resumed in a few months, and the patient is now pregnant. This result is to be expected, for in the ovaries of a woman near the menopause the follicles are fewer more fully developed, and be closer to the surface. The entire follicular equipment of the ovary is, therefore more susceptible to complete destruction under the influence of radiation.

microscopic examination of the uteri removed after unsuccessful treatment with radium reveal no very definite changes. One would expect a sclerosis of the stroma which might bring about a temporary or permanent obliteration of the endometrial capillaries. From the cases just demonstrated in this clinic it would seem that a small dose of radium may bring about a temporary change in the endometrium without affecting seriously the function of the ovaries. Thus in the case of the thirteen-year-old girl who had a very small dose of radium the menstrual rhythm was immediately produced although with six week intervals. Radium given in sufficiently large doses is capable of destroying the graafian follicles, as has been shown by the examination of ovaries removed after radium treatment.

I have recently performed a hysterectomy with removal of the ovaries in a patient who seven months before had had a full dose of radium for severe hemorrhages in association with a broad pedicled submucous fibroid. After five months of complete cessation profuse bleeding recurred. Microscopic examination of the ovaries revealed a complete absence of follicles. In this case the recurrent bleeding must have been independent of ovulation and probably came from the fibroid itself.

The extent of the destruction of the follicles depends on the size and length of time of dosage and also on the age of the patient. You will remember that the primordial follicles are formed near the center of the ovary and that as they develop they migrate toward the surface finally culminating in a ripe corpus luteum or in an atretic follicle. A large dose of radium is sufficient to destroy all the follicles in the ovary both young and old. But it may be imagined that a moderate exposure of the radium may kill only the older and riper follicles that are near the surface, while the younger and less developed bodies escape its influence. In this way may be explained those cases like the first in our series, in which the menstrual function is suspended for several months, only to be resumed in natural manner. In other words, menstruation ceases during the period of time required by the younger follicles to mature. The fact that the menstruation in most cases is restored without the

CLINIC OF DR. FRANK H. LAHEY

BOSTON CITY HOSPITAL

OSTEOMYELITIS. GOITER (HYPERTHYROIDISM)

THE following 2 cases are submitted because of their interest, and to illustrate the method of conducting the fourth year students' Surgical Clinic for T. H. Medical School at the Boston City Hospital.

A list of typical major surgical conditions is made out, and each week one such case is assigned in the wards to a group of four students for thorough working up and presentation to the class in the surgical amphitheater on the following Wednesday morning at 11 o'clock, the clinic running on indefinite time until discussion, demonstration, and operation are over.

Under the direction of Dr. J. H. Shortell, of the hospital out-patient staff, complete history is taken, which not only includes data relative to the condition for which the patient enters the hospital, but also investigates other sections for related or independent symptoms. We feel that history taking, particularly in surgical clinics, has become almost a lost art, and that it should be revived. This point is emphasized because we are impressed with the readiness with which surgical house officers arrive at a diagnosis and then write history to prove it.

In the same way, under direction, complete physical examination is made, then checked up and criticized by Dr. Shortell or the house surgeon.

In conference with Dr. Shortell, an outline of all laboratory data or consultation with men representing special branches is prepared, and arrangements made with the various laboratories to obtain such data. After the collation of this material, it is included under the history—brief differential diagnosis written by the group, and the entire report submitted to Dr. Shortell for criticism. It is then sent to the medical school and mimeographed, so that at the hour of the clinic copies are available for each student and for visitors.

At the hour of the clinic the report is read to the class, a medical stenographer supplied by the school being present. At the end of the report the discussion is taken up by Dr. Lahey, the case demonstrated, discussed, and operated upon, the operation explained, and gross pathologic material demonstrated. The remarks are preserved by the stenographer transcribed, edited by Dr. Lahey, mimeographed, and copies returned to the students at the next exercise, to attach to the mimeographed report of the case.

Where consultation has been held with other departments, such as the blood laboratory, the x-ray department, the chemical laboratory or the pathologic department, they are requested to discuss their findings before the class in order that these may be mimeographed and preserved with the notes of the case.

in bone. Little cavity found. No pus obtained. Rubber drainage. Dry sterile dressing.

Preoperative diagnosis Osteomyelitis.

Postoperative diagnosis Periostitis.

x Ray No. 62,998 Bl. "Lateral view only Dressing obscures bone desired.

Temperature gradually became normal and wound stopped draining Granulation begun.

September 24 1920 Temperature normal. Wound granulating Boric ointment dressing Little motion in elbow Discharged relieved to Out-patient Department.

These notes are an abstract of the patient's previous stay in the hospital on another service.

October 6 1920 Entered IV Surgical Service as a clinic case. Name Philomena S Boston Mass. age nine years.

Born in Italy coming to this country at seven years of age

Chief Complaint—Pain and swelling of left elbow

Family History—Father and mother living and well. Both born in Italy Four sisters and one brother living and well. No family history of tuberculosis insanity cancer diabetes or hemophilia. No venereal history in parents.

Past History—Patient was a full term baby normal delivery and breast fed. Walked talked appearance of teeth, etc. all within normal time limits. General health good Best weight 55 pounds. Weight now 50 pounds. No mumps, pertussis, scarlet fever rheumatic fever chorea pneumonia typhoid, or malaria. Had measles three years ago and tonsillitis four years ago. Between the ages of three and six patient gives a history of suspicious "night cries." No other illness. No accidents. Operated on at this hospital a month ago for the same trouble she now has. No other trouble.

Eyes.—No disturbance in vision or any other trouble

Ears.—No deafness, tinnitus, or discharge.

Nose.—No discharge or epistaxis.

Throat.—Has had tonsillitis. Occasionally has a sore throat.

Cardiopulmonary.—No dyspnea upon exertion. No preprecordial pain palpitation, edema, vertigo syncope pains in

The case is returned to the ward after operation, and is followed by the group of four students either throughout the school year or until the patient is entirely relieved and free from symptoms.

During his stay in the hospital the patient is shown at each weekly clinic, with report of his recovery treatment, and complications. Microscopic sections of the material removed are provided by the pathologic department for demonstration at the next weekly clinic following its removal.

After leaving the hospital the patient is brought to the clinic from time to time by a member of the group of students having him in charge, so that record may be made as to his complete, partial, or incomplete cure. These weekly reports, with remarks by Dr. Lahey are recorded by the stenographer and supplied to the students to attach to each case to make it complete.

By this method each student has an opportunity to participate in the accumulation of all available evidence in a case. The entire class has the opportunity to hear the evidence, the students differential diagnosis, and Dr. Lahey's discussion, to see the diagnosis as established by operation, to observe and have explained the steps of the operative procedure, to see gross pathology when demonstrable, to see microscopic pathology at the next exercise, and to see and follow the case to cure, partial cure or failure.

OSTEOMYELITIS

Student's Report.—Name Phillomena S. Nine years. Serv IV Surg Ward II

Precious Admission—August 1 1920 on another service.

Admission Diagnosis—"Septic elbow"

Present Illness—Patient states she felt soreness in region of left elbow without any history of trauma or sepsis. Gradually swelled became red and very tender. Treated by a local physician, and had x-ray taken which showed nothing. Sent in here for treatment.

Local Examination.—Left elbow markedly swollen giving it the shape of a spindle. Swelling extends down as far as the fingers. Very tender upon pressure. Temperature 103° F

Treatment.—August 20 1920 operation. Through-and-through drainage. Pus obtained. Culture taken. Rubber drainage. Dry sterile dressing

Flaxseed continued.

Preoperative diagnosis Septic elbow

Postoperative diagnosis Septic elbow

Culture from wound showed *Staphylococcus aureus*.

August 25 1920 operation. Radius exposed. Holes drilled

in bone. Little cavity found. No pus obtained. Rubber drainage. Dry sterile dressing.

Preoperative diagnosis: Osteomyelitis.

Postoperative diagnosis: Periostitis.

x Ray No. 62 998 BL. 'Lateral view only. Dressing obscures bone desired.

Temperature gradually became normal and wound stopped draining. Granulation begun.

September 24 1920. Temperature normal. Wound granulating. Boric ointment dressing. Little motion in elbow. Discharged relieved to Out-patient Department.

These notes are an abstract of the patient's previous stay in the hospital on another service.

October 6 1920. Entered IV Surgical Service as a clinic case. Name: Philomena S., Boston, Mass., age nine years.

Born in Italy, coming to this country at seven years of age.

Chief Complaint—Pain and swelling of left elbow.

Family History—Father and mother living and well. Both born in Italy. Four sisters and one brother living and well. No family history of tuberculosis, insanity, cancer, diabetes, or hemophilia. No venereal history in parents.

Past History—Patient was a full term baby, normal delivery and breast fed. Walked, talked, appearance of teeth, etc., all within normal time limits. General health good. Best weight 55 pounds. Weight now 50 pounds. No mumps, pertussis, scarlet fever, rheumatic fever, chorea, pneumonia, typhoid or malaria. Had measles three years ago and tonsillitis four years ago. Between the ages of three and six patient gives a history of suspicious "night cries." No other illness. No accidents. Operated on at this hospital, a month ago for the same trouble she now has. No other trouble.

Eyes—No disturbance in vision or any other trouble.

Ears—No deafness, tinnitus, or discharge.

Nose—No discharge or epistaxis.

Throat—Has had tonsillitis. Occasionally has a sore throat.

Cardiorespiratory—No dyspnea upon exertion. No pre-precordial pain, palpitation, edema, vertigo, syncope, pains in

chest, chronic cough, expectoration, hemoptysis, night-sweats, chills, or fever

Gastro-intestinal—Appetite good all foods agreeable. Drinks moderate amount of water. No trouble in swallowing. No nausea vomiting, indigestion, belching of gas, or heart burn. Never jaundiced. Bowels regular without cathartic. Stools well formed and soft in consistency. No diarrhea. No black tarry or clay-colored stools.

Genito-urinary—Micturition three or four times a day does not get up at night. No polyuria, hematuria, incontinence suppression, retention frequency or dysuria.

Neuromuscular—No convulsions, mental changes, stiffness, paralysis, numbness, dizziness, fainting anesthesia or paresthesia.

Habits—Does not drink tea or coffee.

Present Illness—Temperature, 98° F. Pulse 88. Respirations, 20. Blood-pressure systolic 90 diastolic 60. It is stated that two months ago without any history of trauma or sepsis, the patient suddenly felt pain in her left elbow. In three or four days the pain became more severe and the elbow was swollen red hot to the touch, and tender upon pressure. Patient felt feverish. A local physician was called, who recommended hospital treatment. At this hospital the patient was operated on twice. A small cavity was found in the shaft of the radius and pus was drained. Almost two months after entrance patient was discharged relieved to the Out-patient Department. At time of discharge temperature was normal the wound was granulating. Within a week after discharge draining began again. Patient re-entered on the IV Surgical Service. There is no history of any illness immediately preceding the onset of this trouble.

Physical Examination—Fairly well-developed and nourished female child of nine years, up and walking about the ward carrying left arm in sling but in no apparent pain. Child is quite easily excited.

Head—Symmetric no exostoses or other abnormalities.

Eyes—Conjunctivæ clear pupils equal and regular react

to light and distance. No nystagmus, strabismus, or signs of hyperthyroidism. No ptosis.

Ears—Hearing good. No discharge or tophi. No tenderness over mastoid region.

Nose.—No discharge or obstruction.

Mouth. Teeth.—Fair condition all present no pyorrhea alveolaris.

Tongue—Clear and moist protrudes in median line without tremor. Mucous membranes slightly pale.

Pharynx—Slightly reddened. Tonsils very much enlarged. No membranes.

Neck.—No rigidity glandular enlargement, or pulsations.

Chest.—Symmetric. Expansion equal. Normal in shape. No signs of rickets.

Lungs—Resonant throughout. Vocal and tactile fremitus normal. No rales. Over apices, posteriorly the expiratory murmurs are somewhat prolonged. Breath sounds otherwise normal.

Heart.—Apex impulse seen in the fourth left interspace 6 cm. to left of midsternal line inside nipple line. Right border 1 cm. Left border 6 cm. No shocks or thrills palpable. Sounds regular, clear, and of good quality. No murmurs heard at any valve orifice. P equals A.

Pulses.—Equal synchronous, and of good tension and volume. Pulse rate 86.

Abdomen—Soft, level and tympanitic. No masses felt. No spasm or rigidity. No hernia. Liver kidneys, and spleen not palpable. No costovertebral tenderness.

Lymph-glands—No posterior or anterior cervical axillary epitrochlear or inguinal glands palpable.

Genitalia—Negative.

Arms—Right arm normal. Left arm See *local*. No club-fingers.

Legs—Symmetric and equal in length no deformity.

Reflexes—Knee jerks present, equal, and active. No Kernig, Babinski, or ankle-clonus.

Skin—Clear and moist. No eruption.

Osteomyelitis—The acute onset with fever the swelling tenderness redness, and loss of function prior to previous admission to this hospital, where operation on the left forearm showed a small cavity in the shaft of the radius, and the subsequent draining of pus, bacterial examination of which showed *Staphylococcus aureus*, all point toward osteomyelitis. The persistent discharge since then is another fact in favor of osteomyelitis, as are the x ray findings.

From the preceding history and the clinical and laboratory findings, corroborated by x ray findings, we believe a diagnosis of osteomyelitis of the shaft of the radius and probably of the ulna, as well, is justifiable.

Despite the absence of any history of trauma, this condition possibly may have been preceded by trauma and may be an extension from a periostitis following cellulitis.

The facts that the patient has enlarged tonsils and that there is a history of preceding tonsillitis and an occasional sore throat suggest that the tonsils may have been the local foci from which the infection spread, starting an acute process in the radius, resulting in osteomyelitis.

Patient brought in, etherized.

DR. LAHEY You can see in this x-ray plate (Fig 233) the osteomyelitic process involving the entire radius. This process having involved the entire shaft of the radius it will be completely and in a measure is now surrounded by beginning new bone. Soon the old shaft will be but a foreign body acting as such and delaying healing until it liquefies and is discharged through sinuses or removed by operation. We propose to do that now that is, remove the entire shaft of the radius, depending upon the preserved periosteum to regenerate a new radius. We do this, first, to shorten convalescence and second, that the old shaft may not interfere with the production of a strong new radius.

We now make an incision along the radial side of the forearm down to the radius, carefully controlling all bleeding so that dry field may be had. This incision extends from the wrist to the upper epiphysis of the radius. The periosteum is not incised

throughout the length of the radius, and you can all see its thickness and beginning deposit of bone in it. By means of the sharp periosteal elevator the entire layer of periosteum is raised from the old shaft, taking care that the genetic layer of bone cells close to the shaft is raised with the periosteum, and not

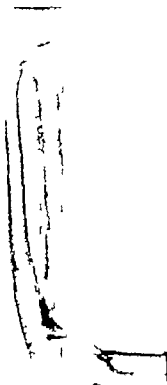


Fig 233

left behind with the shaft. This elevation is now carried from the lower end of the radius to its upper end and completely around it. We now gently break off the upper end of the shaft, where it readily separates at the epiphyseal line and in the same way break off the shaft at the lower epiphyseal line. We have

now excised the entire old shaft and you may see here the gutter made by the thickened remaining periosteum. We again carefully control bleeding. Insert Dakin's tubes in this cavity and now place the arm and hand in plaster taking pains as you see, that the hand is held in such relation to the wrist that the remaining radial periosteum is kept in proper extension.

The important facts in connection with this case are that, particularly in children, practically all spontaneous infections about joints are to be strongly suspected of originating from an epiphysitis of hematogenous origin. In this type of lesion, the epiphysis being close to joints, there results a swelling which extends about the joint, and to the inexperienced frequently suggests a joint infection. Many of the cases of this type which come into this hospital are sent in with that diagnosis. Remember that in children osteomyelitis originating as an epiphysitis is many times more common than a joint infection.

In such an early case of epiphysitis it is important also to know that the x-ray findings are negative and that the decision whether to drain the bone or not must be based upon the clinical evidence only. It is only by wide, early and adequate exposure and drainage of the bone that involvement and destruction of the entire shaft, such as have occurred in this case can be avoided.

It is important also to realize that a complete removal of the diaphysis in a case such as this should not be undertaken unless it is evident that the osteomyelitic process has involved the entire shaft of the bone, as, indeed, is usually the case with the exception of those rare instances in which there is a localized pus process which has become walled off and surrounded by dense bone then known as bone secess or Brodie's secess, and requiring only complete sterilization of the cavity and removal of a considerable portion of the wall.

Furthermore removal of the shaft should not be undertaken until it is evident by x-ray that a fair start toward the development of a new shaft has already been made by the periosteum surrounding the old one. This is less important in bones such as the fibula or radius, since they are not the sole support of the extremity as is the case in the humerus. In that bone

however removal of the old shaft cannot safely be done until the involucrum bone is of sufficient denseness to support itself and maintain the normal length of the bone against the traction of muscle connecting it with other and unaffected bones.

In the removal it is important, as I have already stated that the thickened and bone-developing periosteum should be carefully raised from the old shaft in order that none of its bone forming layers of cells are detached from it and removed with the old shaft. Another important point is that care be taken that the diaphysis only be removed and the epiphyses left behind uninjured and able to function in their capacity for controlling distance growth in the new shaft. If the proper time is selected for the removal of the old shaft, by gently moving the shaft and head they may be made separate very readily at the epiphyseal line.

It is extremely important, if the new growth of bone is still so limited that the periosteum is still flexible to apply splints or plaster in such a manner that the extremity is maintained in its full extension.

We will show you Philomena from time to time and you will have an opportunity of observing by x ray and palpation the development of her new radius.

October 13 1920

DR. LAHEY The little girl, whose radius we removed last week is here the x-ray being taken through the plaster of course is not very good but it shows the ulna and the absence of the radius. They will bring in the little girl and show you the arm while we are scrubbing up for this case. I have not done this dressing myself but under Dakin's solution the granulations, as you will see are bright, clean, and healthy

November 24 1920

DR. LAHEY You will recall Philomena, whom you have seen many times, whose entire radius we excised as a sequestrum leaving the shell of periosteum after the excision. When seen by you before the bone had not begun to develop so as to be seen

by x-ray. We will show you the arm in the internal angular splint and here by x-ray (Fig. 234) is the radius with definite growth of bone. Eventually this radius will be developed from the periosteal shell which was left behind. At the present time the growth of the bone is diffuse but as soon as the bone deposit is greater it will solidify and take on the form of a new radius. In the meantime the hand is held by a splint to prevent deformity of the forming radius. Here you see the irregular outline and the epiphyses left behind at the lower and upper ends; this means that the articulating surface will remain unaffected. She should have good rotation because the end of the head of the radius was not removed and should also have good flexion at the wrist. The wound is gradually closing in and I doubt if we shall be able to close it by secondary suture but inasmuch as it remains clean, the granulations healthy and the bone developing we are quite satisfied.

December 1, 1920

DR. LAHEY: Here is Philomena again; she shows a tendency to swing her wrist over which must be corrected otherwise the radius will be shortened. We must put an apparatus on which pulls down on the radius and we can do that best with an internal angular splint and a pistol-grip splint.

This is the x-ray plate¹ of Philomena's arm, showing considerably more bone regeneration than the previous one.

December 11, 1920

DR. LAHEY: This is a later picture (Fig. 235) taken yesterday of Philomena and you see the further ossification of the radius taking place irregularly to be sure but eventually that irregularity will smooth out, so that at the end of a year Philomena will have a fairly smooth radial shaft. Notice also that the epiphysis is intact on the upper end and the epiphysis on the lower end is also intact, so that the distance development in the shaft should not be interfered with. The student who has had charge of Philomena's case reports that a small epicle of bone was removed from the sinus the other day. In addition, those

¹ Good repetition, not all of the x-rays are shown.

of you who are near will see a thickening of the periosteum of the ulna which is reported by the x Ray Department as osteomyelitis of the ulna. I am unable to say at the present time whether



Fig. 234



Fig. 235.

that will result in destruction of the ulna also or not. I should say probably not. She now has the radius replaced by solid bone from one end to the other. You see she has a little rotation in

her radius. You can feel distinctly the entire shaft of the radius firm as a solid piece of bone running from the upper to the lower epiphysis. There are, as you see, three small sinuses left, which granulate and I believe that within a short time, a few weeks, these sinuses will be closed and then it will be only a question of time for the radius to smooth out and be re-established as a completely regrown radius.

January 5 1921

DR. SHORTELL. They have been taking the temperature of this patient in the Out-patient Department every morning, and it has been normal. There has been no flare-up. The position of the bone is very good. You can see now that she has formed a new radius which is absolutely firm. The granulating area on that wound will be burned down with silver nitrate. She can flex a little bit beyond a right angle and can extend her arm to about 30 degrees of normal. There is no apparent osteomyelitis of the ulna.

February 2 1921

STUDENT. Since you last saw Philomena she has been in the Convalescent Home at Wellesley and then came back to the Out-patient Department. While she was out at Wellesley they took off the pistol-grip splint and put on an ordinary anterior splint.

DR. LAHEY. Can you see this little round shadow by x-ray (Fig. 236) in the bone? I question if this is not a sequestrum and this a cavity particularly since at the lower end of the incision Philomena has, as you see, small granulating wound which has persisted while the remainder of the incision has entirely healed. The student in charge of this case states that the x Ray Department say that it is an artifact, particularly if the entire diaphysis has been removed. You all know that the entire diaphysis has been removed because we have all seen it from one epiphyseal end to the other and had it in our hands. The reason they ask this is because this portion looks like cortical bone. It is not cortical bone but is entirely new bone. The entire shaft is regenerated and the distance growth is perfect in Philomena's arm. Her wrist is normal, its line is perfect. The

rotation is fair due to the fact that the head of her radius was left, being the epiphyseal end. The flexion covers a few degrees—I should say ten—beyond a right angle the extension is perhaps 50 per cent. from a right angle to full extension. I see no reason since the joint was not involved in the process, why she should not eventually get full flexion and extension and almost full rotation.

You will recall that in a previous x-ray there was a question of osteomyelitis of the ulna due to periosteal thickening and reaction. This has practically disappeared in this plate there being almost no periosteal thickening.

Notice that in the x-ray there is a rough, ill-shaped radius but time will take care of the roughening in this case and will eventually produce a perfectly smooth radius. If you think these surfaces will not smooth out, recall the overlapping fragments on a femur. You will occasionally see lipping of the two ends of a femur so (illustrating) that the ends will catch and unite and on x-ray there will be a jagged irregular callus, yet at the end of a few years the bone is straight. The ability of nature to smooth off rough ends and to straighten out irregularities is remarkable particularly in growing children.

Philomena should come back now for massage and manipulation though she no longer needs to wear a splint.



Fig. 236.

February 16 1921

STUDENT The last time Philomena was here the splint was taken off and she was coming back to the Out-patient Department for massage and passive motion. She has as yet very little more motion than she had at the last time she was shown, except in the fingers, where she has a considerable degree more motion. There have been no more x ray plates taken since the last time.



Fig. 237

DR. SHORTELL The last time Philomena was here she could not grasp anything—her grip was poor. Now she has fairly good grip the motion in her wrist is pretty good and her elbow motion is about the same as it was at the last time. She holds her arm half-way between supination and pronation. She cannot

pronate at all, but can supinate. This sinus is still unhealed and if you remember the x-ray plates that is about the place where she had that questionable sequestrum. The best way to treat her is to let her use the arm as much as she can and in that way she will gain motion.

March 2 1921

DR. LAHEY Here you see Philomena again, and there is little to add except that she still has the sinus, which I think proves pretty definitely that the shadow which we saw is a cavity containing a small sequestrum. Unless this closes very soon we will give her anesthesia, open the sinus and remove the sequestrum which is no larger than a BB shot.

She has now more flexion and 50 degrees of extension from a right angle. She has fairly good rotation, good motion in her wrist, and you can see that she has good symmetry of her forearm. The irregularities of the radius are beginning to smooth out, and she has a firm strong radius.



Fig 238

Figures 237 and 238 show the appearance of the arm at this time.

INTRATHORACIC GOTTER (SECONDARY HYPERTHYROIDISM)

Student's Report.—November 24 1920 Name Irving
M P Service IV Ward P



Chief Complaint.—Weakness, breathlessness, and sweating on least exertion.

Family History—Father died of tuberculosis at the age of thirty-two. Mother living and well. One sister and one brother living and well. No history of rheumatism, gout, hemophilia, insanity, cancer or gutter.

Marital History—Married twenty-nine years. One son living and well. Wife has had no miscarriages.

Past History—Born in Richmond, Vt. Age fifty-eight years. Has lived in New England most of life. In childhood had measles, whooping-cough, and mumps. No chicken-pox, smallpox, K. L. tonsillitis, chorea, rheumatism, typhoid, scarlet fever, pneumonia, malaria. Present weight 115 pounds. Loss of weight gradual. States heart has always been rapid.

Trade.—Wood-worker in piano factory.

Habits.—Moderate use of alcohol. One cup of coffee, two cups of tea daily. Formerly six cigarettes, lately twelve cigarettes daily.

Injuries—When twenty years old received a glancing blow from an axe on back of head, unconscious several hours. Had three middle toes, left foot, cut off by axe at another time. States memory has always been poor. Has had dull headache, especially at night, most of his life.

Present Illness—About twelve years ago noticed loss of energy, felt himself losing strength. Was grateful when he had an opportunity to rest. For the past twenty-five years has had dyspnea and palpitation at times on slight exertion. No cough or expectoration. For some years has had asthmatic attacks. Does not know cause. Finds it hard to get to sleep, wakes easily, averages five hours sleep. No vertigo or fainting. After lying on his back for some time experiences difficulty in enunciation, which disappears after a few words when in an upright position this does not happen. Voice at times "breaks." Weakness and breathlessness have gradually increased. Perspires very easily. Thinks he can stand cold weather much better than formerly. Was once very sensitive to cold. Has had a few spells of dyspnea lasting two or three hours, some half a year ago.

which were nearly fatal, he thinks. Has no difficulty in swallowing. Appetite good. Bowels regular. No nausea or distress. No jaundice. Nocturia 1 diurnal 2. No dysuria, hematuria, or pyuria. For the last few years he has had periods of lassitude lasting from two to four weeks. Above symptoms have gradually increased. Has had no pain hemoptysis, night-sweats, colic, or diarrhea.

Physical Examination—Well-developed and fairly nourished white man, lying comfortably in bed. Conscious, rational, and in good spirits. No apparent mental disturbances. On entrance, temperature 98.8° F. Pulse 96. Respirations 24.

Head.—Symmetric slight protuberance of left occiput. No exostoses.

Eyes.—Wears glasses to read. Marked arcus senilis. Sclerae clear. Pupils regular react to light and distance. Right pupil much smaller than left. No photophobia nystagmus lachrymation, lid lag or palsy. Slight exophthalmos and tremor of lids. Conjunctivae normal. Right eye normal vision. Left eye, vision weak and definition poor. Von Graefe's sign absent. Right eyelid droops lower than left when closed. More tremor of right eyelid than of left.

Ears.—Hearing much better in right than left ear. No discharge, tophi, or mastoid tenderness.

Nose.—No deformity no discharge. Slight obstruction to breathing due to slight congestion in right inferior turbinate. Many hard colds. No epistaxis.

Mouth.—Mucous membrane normal. No herpes or fissures. Tonsils normal. Tongue coated, yellowish, and fissured protrudes in median line some tremor. No ulcerations. Teeth gone. Upper and lower plates. No sore throat. Hoarseness at night.

Neck.—Visible pulsations, more marked on right. No tracheal tug. Cervical glands not enlarged. No rigidity. Larynx displaced 1 inch to left. Right lobe of thyroid gland really enlarged. Apparent boundaries by palpation, upper border at lower level of thyroid cartilage. Right border of anterior margin of sternomastoid and extending below the

clavicle—The left lobe seems to be somewhat enlarged but owing to the displacement of the trachea to the left this enlargement is probably more apparent than real. In swallowing the palpable portion of the gland forms a distinct bunch on the right, which rises and falls. There is no pain tenderness, or redness over either lobe. The left lobe is firm and elastic. Pulsation palpable through tumor. The surface is smooth.

Skin—Good texture warm and moist. Slight papular rash on abdomen. No jaundice or pigmentation.

Thorax—Symmetric. Expansion equal and regular. Back spine negative.

Lungs—Resonant except for area of dulness below right clavicle extending to second rib. Normal vocal and tactile fremitus. Normal vesicular breathing. V rales. Respiration 25.

Heart—Upper border not made out. Right border 3 cm. from median line. Left border 8 cm. from median line. Apex-beat felt as thrust at sixth interspace just outside midclavicular line. Sounds are regular. First sound at apex accentuated. No murmurs.

Pulse—Regular and fair volume. Radials synchronous and of equal force. Rate 96.

Blood pressure—Systolic 125. Diastolic 75.

Capillary pulse in lips not observed under nails. Throbbing in finger-tips. No venous pulse in veins of hand.

Abdomen.—Symmetric. No spasm masses, ascites, or edema. Fulness and tension normal. No scars or tenderness. Pulsation from heart impulse seen and felt in costal angle. Liver gall-bladder and spleen not palpable. No herniae or inguinal gland enlargement.

Extremities—Rapid fine tremor of fingers on extension. Tibiae smooth, no arthrosities or ulcers. Old carbuncle scar. No edema.

Venous-muscular—No twitching spasm anesthesia paresthesia or ataxia. Has slight general muscular tremor. Knee-jerks equal and increased. No ankle-clonus, Babinski or Kernig. Forehead wrinkles freely on looking up.

x Ray (Fig. 239) — Shows a circular mass covering thyroid area extending slightly above and below the clavicle. Boundaries lower limit at level of second costal cartilages extending



Fig. 239 — Not marked deviation of the trachea with narrowing, as shown in operation. Not also shadowed outline of intrathoracic mass

from midline on right about $5\frac{1}{2}$ cm. on the left about $4\frac{1}{2}$ cm. Outline of mass lost above. The trachea shows displacement about 3 cm. to the left.

Laboratory Findings

Urine Amber acid Specific gravity 1026.

Sugar 0 albumin 0 sediment negative.

Wassermann Negative.

Blood W B C. 5800 differential.

R. B C. 4,848 000 Poly leukocytes, 61 per cent.

Lymphocytes, 28 per cent.

Large lympho. 10 per cent.

Eosinophils, 1 per cent.

Smear normal.

Basal metabolism Nov 5 1920 plus 56.2 per cent.

Nov 17 1920 plus 66.1 per cent.

Nov 24 1920 plus 62.4 per cent.

Diagnosis—Intrathoracic goiter with secondary hyperthyroidism.

Discussion.—Besides the four cardinal signs—tachycardia, exophthalmos, gland enlargement, and tremor—we find the disease making slow headway over a long period of years. There are both pressure symptoms and those due to overactivity of the gland.

We find also dyspnea on slight exertion free perspiration, weakness, emaciation, up-and-down movements of tumor mass on swallowing, and we are unaware of any other disease giving such a symptom-complex except intrathoracic goiter with secondary hyperthyroidism.

DR. LAHEY This case from the discussion, is undoubtedly a case of hyperthyroidism having the clinical symptoms of hyperthyroidism—goiter tachycardia tremor (does he have the exophthalmos?—‘very slight’) slight exophthalmos, nervousness, loss of weight, dyspnea free perspiration, weakness—myasthenia is a characteristic symptom of hyperthyroidism—and increased basal metabolism. For these reasons the patient has hyperthyroidism. Because the tumor descends into the thorax, as shown by the x-ray the goiter is in the chest, and is intrathoracic. What goiters are intrathoracic? Colloid goiters, cystic goiters, and adenomata of the thyroid. Of all types the most common intrathoracic goiter is the adenoma, and from the

symmetric outline it is probable that this is an adenoma of the thyroid which has descended into the chest. How do we have also hyperthyroidism? There are two types of hyperthyroidism—primary and secondary. Primary hyperthyroidism is the hyperthyroidism which used to be known as exophthalmic goiter in which there is a symmetric enlargement of the thyroid and the disease in this type is due to overactivity of the cells throughout the gland. That is primary hyperthyroidism. Secondary hyperthyroidism has all the symptoms of primary hyperthyroidism, but the cause is different. It is the result of activity of the cells in the adenoma, the cells in the thyroid gland itself being only normally active. Therefore the treatment is different. The surgical treatment of primary hyperthyroidism must consist in the removal of at least four fifths of the entire thyroid gland to accomplish a cure. The surgical treatment of secondary hyperthyroidism need be only the removal of the adenoma itself because it is the cells within the adenoma which are overactive, and produce the symptoms. In the case of secondary hyperthyroidism surgical cure results from removal of the adenoma. Therefore, this is a case of secondary hyperthyroidism in an adenoma of the thyroid within the chest, as proved by the shadow within the chest—here is the outline of the growth on the x-ray plate—and by the deviation of the trachea. Those of you at a distance even can see on the x-ray plate here the shadow of the intrathoracic mass. The trachea should be straight down in the midline, and here is the trachea pushed over to the left, showing it to be curved out to the left by the pressure of the adenoma. This then, is an intrathoracic goiter with secondary hyperthyroidism.

How do goiters become intrathoracic? If you will recall the anatomy of the neck I think you will understand. First of all, the isthmus of the thyroid rests on the tracheal rings over the upper thoracic aperture (Fig. 240) pressed on by the anterior muscles of the neck with nothing to support it and prevent it going down into the chest. An adenoma develops here in the lower pole of the thyroid, and ascends and descends with each act of swallowing because the thyroid gland moves with deg-

lution that means that there is a constant tendency for the adenoma to mold itself a bed in the downward direction. You will recall that the thyroid is covered anteriorly by the sternohyoid sternothyroid omohyoid and sternocleidomastoid. Therefore there is a constant pressure inward, and with swallowing a downward pressure on the thyroid so there is a constant tendency for an adenoma arising in the lower pole to be pushed

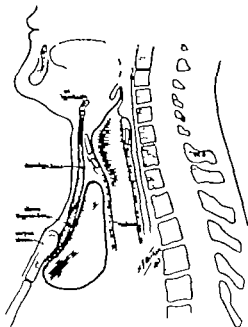


Fig. 240.

down into the chest. You will remember that the chest narrows toward the upper thoracic aperture so that after a portion of the gullet passes the superior strait, to so designate the upper thoracic aperture and then enlarges, the adenoma is pulled or sucked down into the chest until finally it is wholly within the chest.

The first symptom is usually respiratory obstruction increas-

ing as the tumor increases in size and presses upon the trachea such tumors deviate the trachea and often collapse it. If you look down into the trachea from above you find the trachea dented or collapsed instead of being round and these obstructions produce respiratory difficulty varying from slight dyspnea to complete obstruction of breathing necessitating operation as an emergency because of impending suffocation from complete respiratory obstruction.

Therefore in all cases in which the thyroid is suspected of being in the thorax, one should be especially suspicious whenever there is respiratory difficulty. *x* Ray plates should be taken, and the intrathoracic shadow and the deviation of the trachea looked for.

Basal metabolism. As you know the thyroid gland is the gland which controls metabolism more than any other gland in the body and as you also know metabolism—basal metabolism—represents the oxygen combustion necessary to life and all body functions are dependent on oxygen combustion for their maintenance. Therefore if you know how much oxygen per square meter of body surface per minute the individual should consume to be normal and if you know how much that person actually consumes, the difference between the two represents increase or decrease in basal metabolism.

This patient started with an increase in basal metabolism of 56.2 per cent. rose to 66 per cent. and dropped to 62.1 per cent. What does that mean? Approximately basal metabolism is indicative of thyroid activity but only approximately you cannot say accurately but 56.2 plus means approximately that the thyroid is secreting 56.2 per cent. more than normal and therefore we may estimate the patient's sickness in terms of metabolism figures. But do not make the mistake that this is absolute you can only say that the patient is approximately 56.2 per cent. toxic.

We have found in a number of thyroid operations that this is a high degree of toxicity that toxicity of this degree produces a dangerous condition of the heart, and that complete operation in cases with basal metabolism rates as high as these are danger

ous. Therefore to remove the whole gland at this stage would be dangerous. So we are going to ligate both thyroid poles—artery vein and sympathetic nerve. The nerve comes from the superior cervical ganglion and goes down with the artery and vein and innervates the gland. We shall interrupt the blood-supply by about half inasmuch as the blood-supply comes from the superior and inferior thyroid arteries. If we tie in the nerves we shall interrupt the innervation of the gland by about one-half also. This usually accomplishes a gain in weight, a decrease in metabolism, an improvement in symptoms, and allows the patient to come to the final operation for removal of the thyroid gland or adenoma in very much better condition. Now how shall we know that the patient is in better condition after this operation? We will do metabolism tests every two weeks then. If he has a drop in metabolism and a gain in weight, and is improved generally we shall continue and when we have found a maximum drop we shall take him into the hospital for his final operation—removal of the adenoma from his chest. So we will tie the poles this morning, and allow you to see him from time to time and keep you informed as to the metabolism rate and, when he is ready take the thyroid adenoma out of the chest.

Now as to the operation. Hyperthyroidism is a peculiar disease. Any psychic stimuli raise metabolism, overactivate the thyroid, increase the pulse-rate and increase the danger in every way. Therefore we should get these patients to the operation with just as little excitation as possible and we have therefore given this man—we have established a routine to manage these cases— $\frac{1}{4}$ grain of morphin and $\frac{1}{16}$ grain of scopolamin hypodermically two hours before operation, repeating this dose one hour before operation as a rule these patients get to the operating table drowsy, sleepy and many of them do not even remember that they have been operated on at all. Some of them recall being put on the truck, and some of them recall a little about the operating-room. Many of them cannot recall the details of the operation at all. In others, the preliminary drugging is not as successful, and they can recall every detail up to their entrance into the operating-room. They come to the

operating-room, are prepared, and then gas oxygen is given because we do not believe in doing these operations with a local anesthetic. They are excitable, apprehensive, and the pulse goes up on the slightest stimulation accordingly we believe that they are safer if asleep and not psychically stimulated.

Gas oxygen used to be considered the safest anesthetic in surgery. It used to be said that you could not kill patients with gas oxygen. We now know that this is not true. In fact, we believe that gas oxygen is one of the most dangerous of anesthetics in the hands of a novice. It is, however, very safe in the hands of an expert. For these patients it is the ideal anesthetic, as they can be put under very quickly and come out very quickly as with the preliminary drugging they require very little nitrous acid in proportion to oxygen. Dr. Sise gives all these anesthetics for us because once the anesthesia is started, we must depend on the anesthetist for information as to the condition of the patient. He tells us the patient's pulse rate, blood-pressure, and general condition. If the patient is falling we depend on him to stop us and send the patient back to bed leaving us to finish the operation at another time. Therefore the anesthetist must have constant experience in judging the condition of these thyroid cases.

Operation.—We will drape the patient here so that you can see the method. At the present time we do not ordinarily operate cases of hyperthyroidism in this hospital for the reason that we have undertaken to treat here for two or three years perhaps, all suitable cases of hyperthyroidism by x-ray in order to ascertain if possible, the value of x-ray treatment, while at the Deaconess Hospital we maintain a thyroid clinic where we operate practically all cases of hyperthyroidism but this man of course is a mechanical problem primarily because his goiter is causing pressure and will cause more and more pressure. Therefore we treat him surgically. You see the adenoma ascending out of the chest as he breathes. Here is a relatively small goiter showing, but from the x-ray he has a thyroid as large as an orange. By percussion you can appreciate the dulness over the upper chest, showing the adenoma to be down in the

chest. Now it will not be easy to find the pole of this thyroid because it is pulled down into the chest. We are using 2 per cent. novocain in addition to gas.

Failures in this operation are due to the fact that inadequate exposure of the superior pole is made, and not all of the pole tied. We find the inner border of the amnion and the pole directly under it. His pulse which started at 135 has dropped to 120 which shows that he will be able to stand the operation all right. Now we dissect down on the inside pole until we come to the

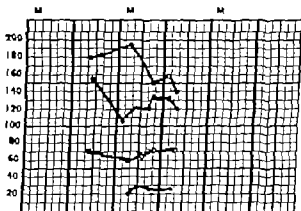


Fig. 241. —Pulse, blood-pressure, and respiration chart made by the anæsthetist during the ligation. The wavy lines indicate blood-pressure the solid black lines, pulse and respiration. Note the moderate pulse-rate throughout, indicating good tolerance of the operative procedure

trachea we are next behind the pole on the inside and we dissect down to the internal jugular on the outside. Now we have the upper pole lifted and exposed on the inner side and on the outer side and we must be careful not to pick up the internal jugular. I pass a ligature around the pole. Here are the artery vein and nerve all included notice that I am taking care not to include the jugular. Here is the pole with the ligature passed around it, tied tightly. We drop the amnion back over the pole.

Dr Sise during the operation keeps a pulse chart the pulse blood-pressure, and respirations are taken and recorded on this chart every five minutes. Now if the patient were not in good condition we should stop and send him back to the ward, and at the end of ten or twelve days have him back again and tie the other pole. His blood-pressure at this moment Dr Sise reports is systolic 150 and diastolic 70 he cannot be in any great shock so that we can proceed with the ligation of the second pole. Some of these cases do not react to ligation possibly this man may be one of them. We have a record of how he has acted during the time he has been under the anesthetic, and from that we will be aided in judging how he will stand the second operation. He has had a trial test, so to speak. We use this same method of charting in all surgical cases so that we may have a preliminary warning of shock. The great danger without this record of course, is that the patient gets too far in shock before we know it (Fig. 241)

This man is still profoundly asleep. He will go back to the ward and sleep four to six hours. That accomplishes just what we want first, drowsiness as he comes to the operation second ease of anesthesia and third he goes back with a period of sleep which carries him through the postoperative stage. He gets preliminary rest ease of anesthesia and postoperative rest, which are what these patients need

December 8 1920

DR. LAHEY He tells me he became conscious at 6 P. M. on the day of the operation Wednesday afternoon after the operation. You will recall that we said he had preliminary drugging with scopolamin and morphin and that the advantage of preliminary drugging was that he would come to the operating room drowsy and only partly conscious of what was going on around him. Did you know anything about what was going on, Mr. P? He says he knew nothing and did not realize that he was in here. So we accomplished the purpose for which we gave him preliminary drugging for he did not know he had been in here and Mr. W. who represents the group of students in charge of this case reports that he became conscious at 6 P. M. Therefore

he had rest before coming here and a long period of rest after he left the operating room.

Student reporting on case *He had no nausea. He was anxious to get up and had to be restrained. He ate the next morning, and on the second day after the operation got out of bed. He felt weak, however. His pulse, as I found it, was about the same as before the tremor was about the same. He said he felt about the same and that it hurt him to swallow at first until after he exercised the throat muscles. On the 27th (three days after the operation) I found the pulse the same. He says he caught cold on Sunday and the temperature went up to 100° F on Sunday and on Monday to 101° F. It was normal yesterday noon. He was back on the regular feeding again Tuesday. His stitches were taken out, and outside of a cold he feels all right. The pulse was 96 yesterday. This morning the temperature was normal and the patient feels better.*

DR. LAHEY *He has had a follicular tonsillitis. As you see here, his stitches are out. Hold out your hands, please. He still has a tremor but a good deal of the tremor has gone. His pulse remains about the same—100 to 110—and he is now ready to leave the hospital. He thinks he will go tomorrow and he will report here every two weeks until his basal metabolism has reached its lowest point then we will remove his intrathoracic gaster.*

January 5 1921

Student's report

Re-entry into hospital.

Previously operated on December 1 1920. Double pole ligation. Left hospital December 9 1920 and stated he "felt fine."

Sleeps about nine hours a night. Appetite good. Not as ravenous as before operation. Breathes easier. Tremor has been much less since operation. Sweating also less and exophthalmos seems less. Has gained 1 pound in weight.

Basal metabolism on December 23d plus 51

On January 2 1921 felt poorly and began to cough. Breath short when coughing. Last admitted January 3 1921. Pulse

90 Temperature 98.6 F Respirations 20 Blood-pressure systolic 150 diastolic 72.

Physical Examination—Tremor of fingers and tongue is less. No appreciable change in size or consistency of goiter Exophthalmos and sweating less. Pulse lower than before operation, regular steady and full.

Throat shows some congestion. Complains of a slight cough, which he says is improving. He is in good spirits and says he is much stronger than before operation, and his nervous poise is much steadier.

January 4 1921 Urine Specific gravity 1020
Albumin 0
Sugar 0.3

Patient brought into the amphitheater under gas oxygen.

DR. LAHEY This man is now in sufficiently good condition, so that we feel he will endure the removal of his intrathoracic goiter. He has not shown the drop in metabolism rate that we would like, but has shown sufficient clinical improvement so that we feel we can complete his operation with safety. Inasmuch as the problem in this case is largely the mechanical one of removing this mass which is causing tracheal pressure, we do not feel that there is anything to be gained by further delay. If he were a case of primary hyperthyroidism, and we were still unsatisfied with his present condition we could perhaps further improve it by continuing the ligations by tying both his inferior thyroid arteries on the inner borders of the scaleni antici. Since this goiter is almost entirely within the chest and the inferior thyroid arteries therefore cannot be approached, nothing further in a preliminary way can be done we must therefore proceed with the removal of the mass.

The collar incision is made as in the operation for primary hyperthyroidism the sternohyoid and sternothyroid are separated from their neighbors in the middle line cut on both sides between clamps, and the top of the intrathoracic mass exposed. My fingers are now gently sweeping around the mass in the superior mediastinum while I am taking great care that they are kept in the line of cleavage between the surface of the goiter

and the layer of condensed connective tissue which surrounds it. This is extremely important, as it is by this measure that the pleura, the thoracic duct in left-sided masses, and the recurrent laryngeal nerves are pushed away from the surface of the mass. No attempt is being made to pry the mass out of the chest and deliver it until it lies entirely free in the *superior mediastinum*.

It is now free and by one finger beneath it on each side it is gently and by pressure from below forced out of the chest until, as you see, it is entirely out and lying here upon the neck, at

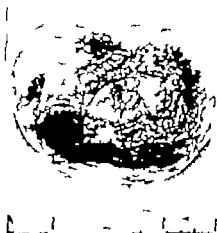


Fig. 242.—The intrathoracic dermoid—note its definite capsule also its size, although no gutter is seen on the neck from preoperative photograph.

tached only by its blood-supply and some connective tissue. We cannot be certain, owing to the stretching and distortion of the recurrent laryngeal nerve which must necessarily accompany the enlargement of such a tumor that we have not pulled upon or injured the recurrent laryngeal nerve on the affected side. If however such is the case, in a short time there will be compensation in the unaffected cord and every satisfactory voice result. In but few cases moreover does such an injury occur.

We are now applying the clamps to the vessels you will

observe that we are taking pains to apply them as closely as possible to the adenoma itself so that danger of including the nerve in ligatures is lessened to the minimum. Notice that we insert a gauze strip wrung out in hot salt solution into the cavity first, to prevent any such sudden strain on the now unsupported pleura as might come with sudden violent coughing, and second, to control any possible oozing while the blood-supply to the goiter is being ligated.

The blood-supply is now entirely tied off and we remove the pack from the cavity in the chest. Those of you who are close

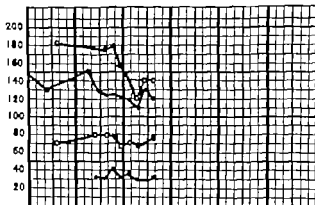


Fig. 243.—Pulse, blood-pressure and respiration chart made by the anesthetist during removal of the intrathoracic goiter. The wavy lines indicate blood-pressure; the solid black lines, pulse and respiration. Note the moderate pulse-rate as to be presumed from the previous operative trial.

at hand may now see the extent of the cavity within the chest and the deviation and flattening of the trachea on one side.

We insert a piece of rubber-dam into this cavity as we wish to keep it drained until it has contracted and obliterated particularly to obviate the danger of infection and consequent mediastinitis.

We suture the neck muscles with mattress sutures to include the longitudinal veins upon them, sew the platysma with 0 plain catgut and unite the skin with horse-hair (Fig. 242).

Dr. Sise reports the man in excellent condition he will remove the gas so that after the dressing is applied we may speak to the patient and make sure that his recurrent laryngeals are intact (Fig. 243)

Patient answers questions as to how he feels in a voice of fair tone.

January 12 1921

Student reporting

The patient spoke before leaving amphitheater showing that the recurrent laryngeal nerve was uninjured.

January 6th. Is better has some cough in daytime. Voice no "vibr", slight hoarseness, voice deeper can talk freely No trouble in swallowing Tremor unchanged. Has very little appetite. Feels good. Pulse 100 to 112. Temperature 99.3° to 100° F. Respirations 22 to 28 Sweating decreased. Appearance good. Has sense of relief from tumor tension.

January 7th Slight tremor Cough better Appetite better Eats solid food. Temperature 99.6° F Pulse 112. Respirations 22.

January 10th Drainage-tube removed in morning. Feels good, but is a little light-headed from $\frac{1}{4}$ grain codein given every four hours. Tremor slightly less. Exophthalmos less. Sleeps well. Appetite good. Cough better Temperature 99.2° F Pulse 92. Respirations 26.

January 21 1921

Student reporting

Wound kept him awake a good deal. Temperature 101.6° F Pulse 102. Respirations 28. Drain removed two days ago. Cough is better Head feels heavy Tremor less. Exophthalmos less. Looks well.

DR. LAHEY I am afraid you cannot see in this x-ray (Fig. 244) at your distance, the course of his trachea now If you remember the trachea in the other picture was well over to the side. His trachea has returned almost to the middle line, and you see that the caliber of the trachea has increased t the



Fig. 244.—This illustration does not bring out the tracheal shadow well on account of the denseness of the as yet not entirely organized cavity left by the removal of the intrathoracic mass. Note the disappearance of the shadow of the adenoma within the chest and that the trachea has returned sufficiently toward the midline to be in the midline shadow.

position where it was pressed upon by the intrathoracic mass. Now what is the cause of his temperature rise? Lack of drainage undoubtedly. When the drain was removed no drain was put

back into the cavity in the chest. A drain will be reinserted at once and I am sure that this will take care of the temperature and reaction. He will leave the hospital in a few days.



Fig. 243.—Photograph of Mr P taken few day previous to operation. Note the absence of any visible goiter upon the neck.



Fig. 244.—Photograph of Mr P voluntarily elevating intrathoracic mass partly out of the chest. Arrow points to the mass.

February 16 1911

DR. LAHEY Mr P weighs 124½ pounds now (Fig 247) He says that while he was in the hospital and they were doing the metabolism test he weighed 116½ pounds. Have you any trouble with your voice? He says that immediately after the operation he had considerable difficulty in talking and complained of this hoarseness as if he had cold. This is typical of these intrathoracic cases. It is clearing up rapidly and he can talk now without difficulty although his voice is still a



Fig 247—Photograph of M. P. two weeks postoperative. Not sinus leading to cavity is best.

Mr Irving P

Date	B Metabolism	Weight		Pulse
		lbs	Kilo	
Nov 5 1920	+56.2%	117 5	53.4	80-98
17	+56.1%	120 1/8	54.6	84-88
23	+52.4%	115 3/4	52.6	84-86
24	Ligation both superior thyroid poles			
Dec 24	+51.0%	116 1/2	52.9	83-92
Jan 8 1921	Removal of an intrathoracic adenoma of the thyroid			
Feb 16	2.0%	124 1/4	56.5	58-64

Fig 248—Showing metabolism rate, body weight, and pulse-rate before ligation of superior thyroid poles, after ligation and after removal of the intrathoracic adenoma. Note the relief from secondary hyperthyroidism by removal of only of adenoma, as evidenced by return of basal metabolism rate to normal, gain in weight and drop in pulse-rate.

little bit hoarse. His wound is healed except for a very small granulating area which ought to heal in a very short time, and he is feeling well. He says he is a new man in every way

February 23 1911

Mr. P's metabolism preoperatively was plus 66 now it is minus 2, so you see he has been relieved of his intrathoracic goiter and also of his secondary hyperthyroidism (Fig. 248)

FROM THE ORTHOPEDIC DEPARTMENT OF THE
MASSACHUSETTS GENERAL HOSPITAL

Tuberculosis of the Knee-Joint. Angioma of the Knee-joint.

By ROBERT B OSGOOD M D

Unexpected End-results Following Treatment of Congenital
Dislocation of the Hip

By ZACHUEL B ADAMS M. D

Traumatic Osteitis of the Wrist

By MARK H ROGERS M D

Tuberculosis of the Sacro-iliac Joint

By M N SMITH PETERSEN M D

The Syme Amputation

By PHILIP D WILSON M D

Spastic Paralysis. Neurotomy (Stoffel Operation) as a Method
of Treatment

By RAFAEL N HATT M D

CLINIC OF DR. ROBERT B OSGOOD

MASSACHUSETTS GENERAL HOSPITAL

TUBERCULOSIS OF THE KNEE-JOINT ANGIOMA OF THE KNEE JOINT

TUBERCULOSIS OF THE KNEE-JOINT

In presenting 3 cases of tuberculosis of the knee-joint in adults we shall give brief case histories first, followed by summaries. We shall then make a statement of belief in regard to the treatment of this serious condition. The basis of this belief is fifteen years experience in the Orthopedic Clinic of the Massachusetts General Hospital.

Case I.—The first case represents a failure in treatment, due very possibly to technic, which we recognize to have been faulty. It is fair to say however that the case represents one type which we have occasionally encountered in which resistance to the infection is very low and the character of the disease at least locally is almost malignant.

J A Age twenty-one. Single. No occupation. Entered the Massachusetts General Hospital in May 1920. Family history negative. Past history negative except for children's diseases.

Present Illness.—Six years ago while in school, the left knee began to feel "funny" in running. There was very little pain and no acute onset. Gradually a swelling was noticed and limitation of motion. Seeking local medical advice, the knee was strapped by his family doctor. In spite of various forms of treatment, and although there have been numerous periods of betterment, the knee remained swollen, became more limited in motion, until five months ago when all motion was lost. The swelling became tense the pain more acute and a loss of weight began.

In the spring of 1920 he came to the Peter Bent Brigham Hospital and we were asked to see the case in consultation by Dr John Homans, who had recognized the true nature of the disease and confirmed it by roentgenologic examination (Fig 249)

The young man was thin, pale and had the furies of pain and anxiety. The knee which had not been immobilized until Dr Homans had seen him, was tense, tender, hot, but not

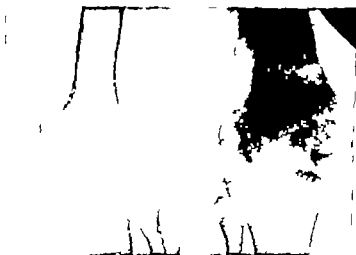


Fig 249—Case I. Lateral and a.p. roentgenograms. Before operation. Hazy and irregular articular surfaces. Loss of substance on lateral condyle.

reddened and was extremely painful to the slightest jar. All motion was guarded by strong muscle spasm. The body temperature did not go above 100° F and the general examination was negative. It seemed in a most unfavorable state for operative interference other than amputation. He had good home in the country and recumbency in a well-fitting cast, with heliotherapy and an antituberculous régime, was advised for a month.

In spite of this treatment, apparently well carried out, he

entered the Orthopedic Service of the Massachusetts General Hospital on May 28 1920 in somewhat better general condition and with a normal temperature but with the knee still tensely swollen and firmly fixed by muscle spasm.

With the hope of rendering the local conditions less acute and more favorable for operation the knee was aspirated to relieve the tension, and translucent, straw-colored fluid was withdrawn. This fluid was injected into a guinea-pig and proved later positive for tuberculosis. After three weeks of further recumbency the fluid returned though the knee was a little less sensitive, and operation was decided upon.

At this time the general examination was negative. No lung involvement could be detected. The urine was normal and the Wassermann test negative.

On May 6 1920 the operation of excision of the knee was performed under ether anesthesia. A tourniquet was applied to the thigh. A quick excision was performed through a U-shaped incision crossing and dividing the patellar tendon, turning back the flap dissecting out very hastily the mass of tuberculous tissue and pannus filling the cavity. Much free fluid and masses of fibrin escaped. The eroded under surface of the patella was removed with a saw and thin slices of the femoral condyles and the head of the tibia were also resected with a flat saw. The angles had been previously calculated by a tracing of the roentgenogram and 15 degrees of flexion were provided. A flat, fresh bone surface on the anterior surface of the femoral condyles was prepared to receive the freshened inferior surface of the patella. Two boiled beef bone pegs were driven through the femoral condyles into the tibia, one from the lateral and one from the medial side. It was later shown by the Roentgen plate (Fig. 250) that these were not of sufficient length to obtain a firm hold. The excised knee seeming stable with raw bone surfaces in apposition, the tourniquet was removed the bleeding other than the ooze from the bone was controlled with plain catgut ligatures, the patellar tendon was reunited and the wound closed without drainage, with silkworm gut. This was a departure from our usual custom of inserting in the upper

corners of the incision small rubber tissue drains to be removed in forty-eight hours. The reason for this departure was that the bleeding seemed well controlled, and we wished in this case to avoid all possibility of secondary infection, recognizing the gravity of the case. A sterilized metal arm splint, bent to 15 degrees, was placed over the dressing held by an assistant,

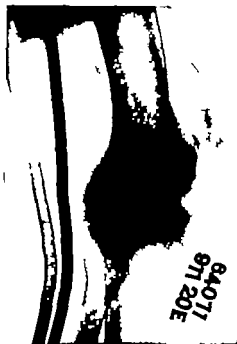


Fig. 250.—Lateral roentgenogram of Case 1. After excision. Bone-pegg insufficiently placed.

and a plaster splint bandage applied. Time of operation, fifty seven minutes.

The patient bore the operation only fairly well. There was a febrile reaction reaching 102° F pulse 106 on the second day but returning to normal on the sixth day.

The stitches were removed on the fourteenth day and con-

considerable serosanguineous fluid and "gelatinous" material was expressed. The skin in many places gave little evidence of tendency to unite. This discharge persisted with a normal temperature and no local reaction, under complete immobility and treatment with the sun's rays.

He was discharged to the Out-patient Department six weeks from the date of the operation, in fair general condition, with no pain or temperature, with the wound still weeping and not entirely but almost entirely healed. He was immobilized in an ankle-to-groin plaster and crutches without weight bearing. An ample window in the plaster allowed free access to the dressing. At the time of application of this second plaster the patella was not fixed and there was motion between the bone ends. He returned to his home under the care of his local physician but returned to the Out-patient Department one month later for observation. He was having no pain, but the knee was more swollen and there were many sinuses of a characteristic tuberculous appearance. There was no union.

He was readmitted in August, about nine weeks after the operation. The Roentgen plates showed that the beef bone pegs, which had been driven only a short distance into the tibia, had not held and there was a space evident between the bone ends. A special open wire splint, providing traction to force the bone ends together was applied, but in spite of alternate pressure bandages and heliotherapy the wound gradually broke down and tuberculous granulation tissue presented.

More perfect immobilization, furnished by a plaster cast with windows relieved his pain, and a Roentgen plate showed that a better apposition of bone ends had been secured by the special traction splint. However the temperature became irregular reaching 102° F at night. There was no local inflammatory reaction. His general condition seemed to be growing steadily less good and his resistance lessening and on September 24th a little over three months after the operation, an amputation was performed by Dr Philip Wilson through the lower third of the thigh.

Two weeks later he was walking on a plaster pylon and

when last seen, a month after the amputation he was in much better general condition, with a healed stump, and walking well on his pylon. A personal communication (May 15 1921) states that the stump remains healed, he has gained in weight, no other joints are troubling him, and he feels generally well.

Summary—The case illustrates a fortunately rare, but an occasionally encountered type of tuberculosis of the joints, in which the resistance to the invading organism, both local and general, seems very low. In the clinic we have had one other case in which no fault of technic entered as it did in this case, but in which the course of the disease was unchecked by a radical resection, a thorough subsequent reopening of the wound, and Dakin-Carrel treatment. Amputation after an even longer interval alone checked the disease.

Both cases were in men not weakened by other disease and with good early histories, but presenting an almost cachectic appearance when they sought our advice.

We recognize as probable mistakes in judgment in this case, first, the endeavor to do too quick an operation, which resulted in our failure to remove thoroughly the gross pathologic tissue, and in an imperfect internal fixation of the femur and tibia. We believe that the time spent in the removal of this pathologic tissue in a case like this is well spent. At least there would be less left for nature to remove when natural reparative processes, as in this case, were at a very low ebb. We believe also it was bad judgment not to insert temporary rubber tissue drains. Much fluid and some hematoma escaped when the stitches were removed. It is possible also that too little bone was removed. Tempted by reports of successes from what are scarcely more than erosions, without removal of tuberculous tissue only thin slices were sawed off the femur and tibia and although on the cut surfaces no gross appearance of tuberculous bone disease was seen, there may well have been cavities proximally and distally. It is quite possible also that secondary infection played some part, though we were never able to prove it culturally or otherwise, but it is hard to prevent in the presence of sinuses which were present from the day the stitches were

removed. We also believe that firm internal fixation, not secured in this case, promotes early union and greatly diminishes postoperative pain.

Granting poor judgment and recognizing faulty technic, we still believe that there are cases of this severe type of tuberculosis of the knee which become rather rapidly fulminating after a long history (in this case six years) of a mild course in which even thorough well-performed operations of resection fail to check the progress of the disease. In these cases our prognosis should recognize the possibility of amputation.

Case II.—The second case is that of a young woman, C B twenty-one years of age, single, a novitiate in a convent, who came to the Out-patient Department of the clinic in October 1911 complaining of pain and swelling in the left knee, of eighteen months duration, and gradual onset without known history of trauma. Lately much kneeling had made the knee worse. The family history was negative. The past history was negative except for typhoid fever eight years previously.

The physical examination was negative except for slight general swelling of the left knee, tenderness over the area of swelling and slight surface temperature. There was no free fluid, but limitation of flexion at about 110 degrees. The Wassermann reaction was not taken at this time, but later proved negative. The roentgenologic examination revealed no bony lesion. She was admitted to the hospital with the diagnosis of tuberculosis of the knee.

A subcutaneous injection of 1 mg. of Koch's old tuberculin gave a positive general and local reaction.

At this time we held strongly to the theory that tuberculosis of the joints might be sometimes primary in the synovia, arguing from the apparent primary infection of other serous membranes. Stimulated by the hope of arresting the process, if it were confined to the synovial membrane, by some local application of an antiseptic, Dr. E. G. Brackett opened the joint, found a tuberculous pannus, but no demonstrable articular cartilage lesion and closing the joint tight about a syringe nozzle, injected a 4 per cent solution of iodoform in pure bland olive oil until

the capsule was slightly distended. By means of a double loop stitch around the syringe nozzle the synovia was drawn together and stitched so that no oil escaped. It was hoped that the bactericidal properties of the iodoform oil would be enhanced by confining it in an air tight cavity and that its oily vehicle would perhaps increase its penetration and inhibit adhesions. The lateral expansion and skin were tightly closed and a plaster cast applied. The convalescence was uneventful. She was seen from time to time in the Out-patient Department, wearing a bivalved plaster cast, which was removed daily for voluntary motion. The knee remained somewhat swollen, but was free from tenderness until December 30 1912 when she was readmitted, fourteen months after the operation, because of increased swelling and tenderness over the whole synovial sac.

At this time the patella was slightly movable, there were 10 degrees of permanent flexion and 30 degrees of motion in flexion. The Roentgen plates still showed no involvement of the bones.

On January 2 1913 a second arthrotomy was performed by Dr. Brackett. The capsule was found greatly thickened and adherent, and from one of the pockets about 1 c c. of oil escaped, injected fourteen months previously. It was hard to determine the exact limits of the joint cavity which was filled with pannus. Adhesions were gently divided and the cavity again filled with 4 per cent. iodoform oil and closed tight.

The immediate convalescence was uneventful and the patient was discharged in a bivalved plaster with 5 degrees of motion. She reported from time to time in the Out-patient Department, and motion increased to 30 degrees of flexion. A light caliper knee brace was applied allowing 25 degrees of motion in the knee, and in August, 1917 four and one-half years after the second iodoform oil injection, she was in good general condition able to do light housework and considered herself a little better than before operation. She was wearing the brace and used neither crutch nor cane but at times the knee was painful. It was thought that the disease had been treated.

On October 30 1920 she reported again because of a return of more acute symptoms in the knee. The brace had been broken for several weeks and she had been bearing her weight without its protection. The local examination showed general capsular thickening but no free fluid. The patella was slightly movable. There was no local heat and only slight tenderness. There was no muscle spasm and slightly increased lateral and antero-posterior mobility 5 degrees of permanent flexion, 30 degrees

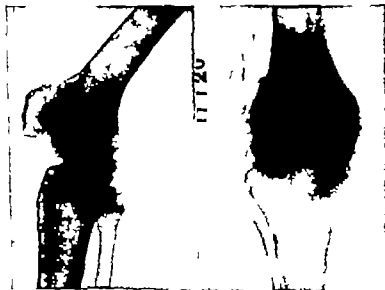


Fig. 251.—Lateral and ant. post. roentgenograms of Case II before operation of excision.

of motion in flexion without pain, and 40 degrees with pain. There was only 2.5 cm. atrophy of the thigh and 1.25 cm. atrophy of the calf. The Roentgen plates showed much increased density of the soft parts and well marked involvement of articular surfaces (Fig. 251). She was sent into the hospital, and under ether anesthesia on November 3 1920 an excision of the knee by the technic described above, but with more careful dissection of pathologic tissue, was performed decussating bone-pegs

being employed as a method of internal fixation and rubber tissue drains inserted for forty-eight hours. The knee was put up in plaster in 30 degrees of flexion. The pathologic report by Dr. Hartwell was as follows: Thin section of the articular surface of the knee-joint. There is considerable erosion of the articular cartilage. Microscopic examination of a section of one of these thin pieces shows fibrous thickening of the synovia with necrosis and an occasional small focal collection of epi-



Fig. 252.—Lateral and ant. post. roentgenograms of Case II after operation of excision.

thelioid cells. There is proliferation of bone and fibrosis of marrow. Tuberculosis.

There was no febrile reaction and almost no pain following the operation. A new plaster bandage from toes to groin was applied in four weeks without pain and the knee felt firm. Union was apparently solid in eight weeks and weight bearing began in twelve weeks. She was last seen on May 9, 1921, when there was free use of the knee without protection and solid union (Fig. 252).

Summary—The case is instructive because of the gradual onset of symptoms, much like Case I, coming on at the same age, but subjected to conservative treatment soon after the onset. In spite of more or less continuous immobilization and two injections of Iodoform oil in the absence of demonstrable bony foci, the disease continued, though apparently arrested for over four years during which she was leading a fairly active life. This again illustrates though in a somewhat different way what may be called the local malignancy of adult knee-joint tuberculosis.

Case III.—The third and last case to which we shall direct your attention is interesting because though clinically and to gross pathologic examination it presented all the symptoms of tuberculosis, the microscopic examination of the tissue removed revealed no evidence of tuberculous involvement, and the roentgenogram was not entirely characteristic, suggesting lues. Even lacking this evidence, we still believe the case to be one of tuberculosis, perhaps of the caries sicca type.

H. J. S. Single. A stable worker. Came to the Out patient Department on December 8 1920 complaining of pain, swelling and stiffness of the right knee. His family history was negative. His past history included the usual children's diseases and a *Nesser* infection twenty years previously without known sequelae. Seven years ago because of a chronic cough and loss of weight, he consulted his local physician, and a diagnosis of tuberculosis of the upper lobe of the left lung was made. He was in a sanatorium for two years and five months, being discharged as cured, although his knee, which had begun to trouble him in 1912 the year previous to his entrance continued to be swollen and somewhat painful.

His present illness dates from 1912 seven years before he was seen in the Out patient Department of the Massachusetts General Hospital. In his occupation as a stable worker he frequently struck his knees on the wheels of carriages, and noticed a persistent soreness of gradual onset on his right. This soreness and swelling persisted while he was in the sanatorium and continued when he resumed his former work after

his discharge. The swelling slowly increased and the motion slowly decreased, until six months ago eight years after the onset, he found he could not ride in short stirrup. He still continued to work, however until about two weeks before coming under our observation. He had been obliged to stand more than usual, the pain became more acute, no motion was possible, and he could not walk without the use of crutches. Pulmonary examination revealed harsh breathing sounds in the left axilla



Fig. 253.—Lateral and ant. post. roentgenograms of Case III before operation. Note small punched out area on medial border of head of femur, seen frequently in bone.

and an occasional "whine" followed by crepitant riles for a few breaths. The general examination was otherwise negative. The right knee was held rigidly in 45 degrees of flexion. There was slight general swelling but no free fluid. No redness or tenderness, and slight local heat. The patella was not movable. There was 25 cm atrophy of the right calf 5 cm atrophy of the thigh. The Roentgen plates (Fig. 253) showed rather extensive destruction of the joint surfaces and narrowing of the joint

space, very little structural bone atrophy almost no proliferative bone changes, but considerable soft part thickening. There was a small punched-out notch on the mesial corner of the articulating surface of the tibia and a little lime salt deposit on the lateral aspect of the shaft of the femur about 12 cm above the joint, which suggested leuc.

A light plaster case was applied and he was recommended for admission to the hospital with the diagnosis of tuberculosis of the knee for excision. Both the blood and spinal fluid gave a negative Wassermann test. No subcutaneous tuberculin injections were given because of the possible lung process.

On December 23 1920 under spinal anesthesia, the knee joint was excised by Dr Charles Peabody then the Senior Orthopedic Intern. Decussating pegs of boiled beef bone were employed as a means of internal fixation, after removal of the articulating surfaces. There was a careful dissection of the gross pathologic tissue, which was quite characteristic of tuberculosis. Rubber tissue drains were inserted for forty-eight hours. The knee was fixed in 30 degrees of flexion because of his occupation as a driver and rider.

The pathologic report from Dr H. S. Hartwell was as follows: Thin sections of the articular ends of the tibia and femur with irregular pieces of soft tissue. The cartilaginous surfaces of both bones show numerous erosions. Microscopic examination of a section made from the soft parts shows vascular granulation tissue and fibrosis. There is no evidence of tuberculosis. Chronic inflammation.

The convalescence was uneventful. The wound healed by first intention. The plaster was changed in four weeks and the knee felt firm. He was discharged to the Out-patient Department. In eight weeks union was apparently firm and weight bearing was begun in twelve weeks (Fig. 254). It will be noted that the boiled beef bone-pegs had already begun to be absorbed.

He was last seen on May 6 1921 a little over four months after operation. Union was firm and he had resumed his work. Flexion remained at 30 degrees.

Summary—The case is interesting because of the negative

pathologic report and the positive lung findings. The history is fairly typical of low-grade tuberculosis of the knee of long duration. The roentgenologic examination and the gross appearance of the tissue at operation seem stronger evidence still. It is hard to conceive of any chronic inflammatory process running such a course, and lues is improbable with a negative history and a negative blood and spinal fluid Wassermann. Again, we have a long history and an eventually incapacitating



Fig. 254.—Lateral and ant. post. roentgenograms of Case III twelve weeks after operation of excision.

joint disease demanding eradication and the operative accomplishment of complete bony ankylosis, which nature unaided seems unable to bring about.

Comment.—These 3 cases seem to furnish illustration for certain beliefs which we have come to hold regarding the incidence course and treatment of tuberculosis of the knee-joint in adults.

1 The onset may be very insidious, and trauma may or may not seem to play an important part. In the first 2 cases no history of significant trauma could be elicited.

2. The early examination and the course of the disease may be very deceptive, leading even experienced surgeons to make incorrect diagnoses and prescribe inefficient treatment. Although frequent almost complete remissions occur and pain and disability disappear we believe physical signs of disease are never completely absent, and the persistence of a gradually increasing disability is the unbroken rule. The course of mild symptoms may extend over many years, but without treatment resistance to the disease may rather suddenly break down as in the first case, and the prognosis as to eradicating the disease by a less radical operation than amputation then becomes doubtful.

3 *Treatment*.—We believe that as soon as the diagnosis is positively made operation should be advised. If the joint is in an acute state of irritation from lack of supportive treatment, we consider it wise to insist on a period of perhaps a month during which recumbency complete fixation of the joint, and general heliotherapy should be enforced.

Operation.—Notwithstanding a number of early encouraging results in mild cases in which no bony involvement could be demonstrated, we consider that arthrotomies and bactericidal injections are so generally inefficient in controlling the disease as to represent a waste of time, if not an actually dangerous delay in eradicating the disease. This is well illustrated in Case II and in many others we have had the opportunity of following.

We believe that as soon as the diagnosis has been positively made and the joint irritation from lack of protection has been quieted down, a radical excision of the joint should be performed by a U-shaped incision, with as careful a removal of gross pathologic tissue as can be accomplished. The method of Sir Harold Stiles of dissection of the whole quadriceps pouch and patella has much to recommend it. The amount of bone to be removed depend upon the extent of the bony involvement, varying from

an erosion to the removal of considerable portions of the articulating surfaces and the curetting of bony cavities.

The amount of desirable flexion should be determined beforehand by a consideration of the social status of the patient. In a woman less than 30 degrees of permanent flexion is rarely desirable. In a man we believe at least 10 degrees will provide a more useful limb for walking standing and sitting than less. In adults, after firm union has occurred, we have not found this permanent flexion to increase with function. It is extremely helpful to calculate the angles of the saw cuts necessary to secure these degrees of flexion before the operation by cutting a paper pattern of an accurate lateral roentgenogram and performing a paper excision.

We believe that some form of internal fixation is to be strongly advised. Ely's experiments in resecting the knee-joints of dogs have demonstrated the fact that without most perfect subsequent immobilization following the resection there is almost no tendency to bony union, since callus does not form about articular bone ends. This internal fixation may be furnished by mortising the bone ends. This lengthens the operative procedure considerably and is rarely firm. The same objection holds in regard to autogenous bone-grafts. Kangaroo tendon in a bundle knot (Osgood and Bull Jour Amer Med. Assoc., October 6, 1917) is quick and fairly efficient. Metal plates and wire nails must be removed later.

We are impressed with the efficiency of decussating boiled beef bone-pegs driven through smaller drill holes from the tibial condyles into the femoral condyles, while the flat bone surfaces are accurately apposed by assistants. We have never known these boiled beef bone-pegs to cause irritation or act as sequestra (10 cases). They are usually gradually absorbed after their usefulness is over. Small rubber tissue drains in the upper corners of the wound provide for the inevitable ooz for forty-eight hours. A thin sterile sheet metal hump splint (Brackett) greatly aids the assistants in holding the limb firm while the plaster is being applied. In stout subjects the first plaster should be a spica including the foot. We expect

little pain following an operation thus performed which should be completed in an hour. There is frequently a rise of temperature for several days, representing we believe, a tuberculin reaction as the result of the operation. The patient should be recumbent for four weeks. The plaster should then be changed, and the case discharged to remain mostly recumbent for another four weeks at the end of which time, if union seems fairly firm crutches are allowed and weight bearing in a bivalved ankle-to-groin plaster is encouraged at the end of twelve weeks. The plaster is removed at night and gradually omitted if union is firm.

ANGIOMA OF THE KNEE-JOINT

After a somewhat cursory review of the literature of joint tumors we have found but 3 cases of angioma of the knee joint reported.

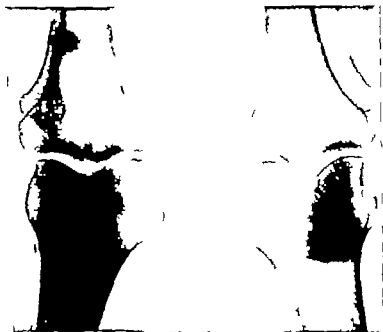
On March 15 1921 a case of supposed internal derangement of the left knee joint in a young married woman of twenty-six was referred to the writer. The subject was a slender healthy looking woman, complaining of rather intermittent symptoms in the knee of eight years duration. The family history was negative. The past history was negative except for the usual children's diseases and the presence, as long as she could remember of a peculiar rather profuse growth of straight hair about 8 cm. in diameter over the last lumbar vertebra and upper portion of the sacrum. She had had a somewhat weak back for many years and some discomfort after lying directly on the back but no severe pain and no nerve root or cord pressure symptoms. After finishing school she had been employed as a stenographer until her marriage five years previous to being seen. There had been one healthy male child, age three years.

Her present illness dated back eight years, and followed a definite injury caused by hitting the medial aspect of her knee a sharp blow against a filing cabinet. Pain and swelling followed and the knee could not be completely extended. A physician was consulted two days later and gradual subsidence of symptoms occurred after a prolonged convalescence of thirteen weeks. She could now walk and dance without discomfort, and motion

was almost normal, though slight swelling persisted. Two years later (six years ago) in stepping down from a chair a sudden "allp" in the knee referred to the inner side, occurred, and swelling and disability ensued for six weeks, followed by complete recovery of function, though a slight swelling persisted. Two years later (four years ago) a similar slip occurred while the patient was reaching to pull down a curtain. A similar convalescence followed. In November 1920 four months ago, while cleaning house, a sudden disability of the knee occurred without the sensation of a definite allp or catch, but with pain referred to the inner side of the joint and with subsequent swelling. After immobilization in a plaster cast for six weeks the symptoms disappeared and painless function has been possible since.

The general examination was negative except for the patch of hypertrophicosis above referred to. Palpation of the lumbar spine revealed an absence of the last two lumbar and first two sacral spinous processes and an apparent spina bifida confirmed by roentgenograms without any meningocele and with only slightly disagreeable sensations to pressure over this area. The examination of all the joints except the left knee showed normal contours and motions. The left knee was slightly limited in extreme flexion and could not be hyperextended. There was 2.5 cm. atrophy of the left calf and 1.5 cm. atrophy of the left thigh. The left knee measured 1 cm. more than the right below the patella, 2.5 cm. more over the patella and above the patella. There was no free fluid in the joint and the change in contour was apparently caused by a slightly movable mass most easily palpable below and to the medial side of the patella, but extending beneath the patellar tendon and indefinitely palpable on the lateral aspect of the joint. This mass was slightly tender to pressure, as was the medial joint line. The joint was slightly relaxed, showing a little lateral hypermobility. There was no deformity of the weight-bearing line. The roentgenogram (Fig. 255) showed slight general atrophy of structure of the bones and increased radiability on the left, but no irregularity of the articular surfaces except at the spine of the tibia, and

no focus of disease. The shadow of the mass in the joint was evident (Fig 256) The Wassermann reaction was negative. The diagnosis of a tumor of the knee-joint and a possible hypermobility of the internal semilunar cartilage was made. Surmises as to the nature of the mass were recorded in the following order 1 A lipoma arborescens etiology trauma. 2 A tumor



Case 255.—Ant. post. roentgenogram of both knees of Case IV. showing increased radiability of bones on left of plate representing left knee of case

of unknown origin and nature 3 A tuberculous pannus. 4 A solitary gumma.

Exploratory arthrotomy with removal of the mass and a possible excision of the internal semilunar cartilage was advised but the consent of the patient was not immediately obtained. One month later however in April the patient accepted the advice and consented to a resection of the knee if at the time

of operation a reasonably certain diagnosis of tuberculosis could be made.

After a forty-eight hours preparation, under ether anesthesia, by an entirely instrumental technique, the following operation was performed under a thigh tourniquet. A 7-cm. incision, beginning about 2 cm. from the medial side of the upper border of the patella and extending distally to just below the joint



Fig. 256.—Lateral roentgenogram of Case IV. Note shadow of tumor mass beneath patellar tendon.

line, curving posteriorly 2 cm. was turned down to the synovia. Through the translucent synovia could be seen a dark mass which immediately presented upon opening the synovia, highly adherent to it. A normal amount of clear synovial fluid escaped. The dark red surface of this mass closely resembled the lobule of a fresh chicken liver. It was covered by a thin capsule or reflection of the synovial membrane. By careful division of

fine adhesions the mass was freed from the synovial membrane and found to be attached by a considerable surface or short pedicle to the infrapatellar fat pad. A lobule of the mass protruded into the intracondylar notch and was adherent to the ligamentum mucosum and to the insertion of the anterior crucial ligament. It extended laterally beneath the patellar tendon and gentle traction gave a sensation of tug which could be appreciated by palpation on the outer side of the joint. Fearing to blindly separate the adhesions on the outer side of the joint, a 5-cm. linear incision was made on the lateral aspect of the joint and the mass discovered quite firmly adherent to the synovial membrane. By careful blunt dissection and division of the adhesions the mass was freed on the outer side up to its infrapatellar fat pad pedicle. In the same manner the lobule extending into the intercondylar notch was freed. The pedicle including a portion of the infrapatellar pad, was last divided, and the lobulated mass, roughly 8 x 4 cm. delivered through the medial incision. The pedicle was examined, but no vessels of large size being detected, no ligature was placed about it. Examination showed the thin investment of the mass to be intact. The internal semilunar cartilage was next inspected. There was no scar of an old or new lesion, but its hypermobility being unquestionable it was removed almost completely. The synovia was not injected and the articular surfaces appeared normal. The synovia was now closed tight on both sides by interrupted fine black silk sutures. The lateral expansions of the quadriceps were closed in like manner subcutaneous stitches of 00 catgut were placed, and the skin incisions closed with fine black silk. A copious compression dressing was applied and the limb not immobilized. There was very little pain following the operation and at the end of seven days, when the stitches were removed, first intention healing had occurred. There was no joint effusion. There were 30 degrees of painless motion. The patient was allowed to be up on crutches on the tenth day and was discharged relieved on the twelfth, allowed to bear a little weight and with 45 degrees of painless motion. This motion has increased until at present, four weeks after

the operation there is over 90 degrees of voluntary flexion, full extension, and painless weight bearing. There is no joint effusion or swelling.

The unopened tumor mass was taken immediately following the operation to Professor S. B. Wolbach, of the Harvard Medical School and his report follows:

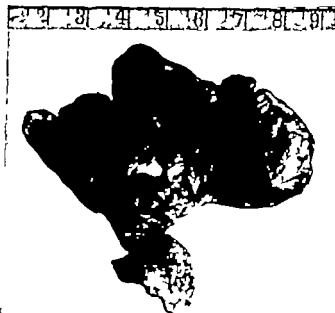


Fig. 257.—Photograph slightly enlarged (note centimeter scale) of cavernous hemangioma removed from Case 15. Pedicle attached is lo/intrapatellar part.

"Material from knee joint. April 17, 1921. (Dr. Osgood.)

"Gross description. Specimen consists of a lobulated mass of tissue, somewhat resembling thyroid gland in appearance and consistence. It weighs 37 gm., is 8 cm. long, averages $1\frac{1}{2}$ cm. thick and 3 to 4 cm. in width. One margin is smoothly convex and has attached to it a tab of fat tissue $2 \times 1 \times 0.5$ cm.

The other margin is irregular in shape with at one end a somewhat flattened process with several projecting tongues. A similar tongue-like projection comes from the middle of its border. The consistence is fairly firm. The color is deep red and it is completely encapsulated. Incision reveals a loose, spongy texture with the interstices filled with blood. The consistence of the tissue as a whole is tough and fibrous, and the gross appearances are consistent with hemangioma (Fig. 257).

Microscopic report. Sections of material taken from three different parts of the tumor are all practically of the same structure throughout. The tumor is made up of large endothelial lined spaces filled with blood and separated by compact connective tissue in which are numerous small normal appearing arteries, veins, and capillaries. One portion of the tumor shows a heavy framework to the blood-spaces, and in all three sections there are collections of lymphoid cells resembling lymph-follicles in that each is supplied by one or more small capillaries and separated by very loose textured reticular tissue. There is considerable refractive brown pigment in the form of granules in the connective tissue of the tumor as a whole. This pigment is contained within cells. There are also a few small bundles of nerve-fibers present. The endothelial lined spaces which give the tumor as a whole a sponge-like texture are of various shapes. Many of them cut longitudinally show very free anastomosis of adjacent cavities. The surface of the specimen is covered with a similar layer of flat cells. In the outermost zone of connective tissue surrounding the tumor as a whole are occasional clusters of small capillary-like blood spaces suggesting the possibility of a cell extension or increase in the size of the tumor.

Diagnosis. Cavernous hemangioma. S. B. Wolbach, pathologist. (Fig. 258.)

Ewing¹ states that cavernous angiomas occur in many situations and may involve nearly all tissues and organs. Cruveilhier reports the case of a hemiplegic of sixty five, in whom a cavernous angioma of the arm involved skin, muscles, tendons, synovial membrane, nerves, and periosteum. Thoma

considered mechanical factors to play a part in the growth of angioma, and Virchow believed that they resulted from the action of local irritation on imperfectly formed vessels, such as those in *embryonal fissures*. The smaller tumors are usually encapsulated and more or less stationary though the course



Fig. 258.—Photomicrograph low power (125) of section through the tumor showing its cavernous nature

of a cavernous angioma is slowly progressive and they may attain large dimensions. They commonly first appear as a circumscribed tumor developing upon the basis of a congenital nevus. Their texture is roughly that of a sponge.

The 3 cases of angioma which have been reported are. A case reported by Zesas, in a strong man of twenty-five years-

dated with attacks of sudden pain and swelling subsiding under rest. There was no history of trauma or venereal disease. At operation a bloody effusion into the joint was found and the tumor mass invaded the overlying musculature. The pathologic report declared it to be a cavernous angioma.

A case of Reichel's occurred in a carpenter of eighteen, without known cause and with symptoms of two years duration. At operation a blue-red tumor was found extending across the joint. The synovia was injected. The pathologic report declared it to be an angiofibroma.

The third case reported is by Oesser occurring in a man of thirty three. The symptoms dated back to his youth, coming on at irregular intervals after slight trauma and after running. At operation the synovia and joint surfaces were reddish brown and there was some pannus formation in addition to the tumor. The pathologic report declared the tumor to be a cavernous angioma.

In all three cases, and in the fourth herem reported, the symptoms closely resembled those of an internal derangement of the joint or a foreign body. The embryonal and congenital theories of origin of these tumors make the association of a spina bifida in our case interesting.

An excellent article on tumors of the knee joint has been written by Züllig. It is evident from his review of the literature that angiomas of the knee joint are rare but benign neoplasms, while sarcomata of various forms are much more common.

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- 5 Züllig: Correspondenzbl. f. Schweiz. Aerzte, October 12, 1917 p. 1208.

considered mechanical factors to play a part in the growth of angioma, and Virchow believed that they resulted from the action of local irritation on imperfectly formed vessels, such as those in embryonal fissures. The smaller tumors are usually encapsulated and more or less stationary though the course



Fig. 253.—Photomicrograph low power (125) of section through tumor showing its cavernous nature

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CLINIC OF DR ZABDIEL B ADAMS

MASSACHUSETTS GENERAL HOSPITAL

UNEXPECTED END-RESULTS FOLLOWING TREATMENT OF CONGENITAL DISLOCATION OF THE HIP

FROM a survey of the end-results, both functional and anatomic, following treatment of congenital dislocation of the hip there is a great opportunity for study and perhaps improvement of technic.

Whether the treatment has been by some open operation or by one of the many methods of closed reduction little interest has been taken in following these cases with a somewhat critical eye to see where the defects in the method have arisen with a view to correcting these defects and improving the end-result. The immediate result being satisfactory that is, the head of the femur appearing to be lodged in the acetabulum the method has been considered a success and has been continued without due attention to the subsequent bony changes and ultimate result. No attention has been paid to the fact that many of these hips, three or more years after reduction, show marked impairment of function, shortening, stiffness, or lary pain, weakness, etc. and that very many in fact, nearly all by roentgenologic examination show imperfections of the head and socket of varying degrees of severity.

Another fact which must be acknowledged is that some of the cases where no treatment has ever been attempted, or where attempts at reduction have failed, or have resulted in a fixed hip in good position, report an excellent functional hip or hips practically without symptoms. We have known good walkers, skaters, and even ballet dancers in this class. Where the hip is ankylosed in good position there is every reason to believe

the head of the femur behind the acetabulum (3) the unhooking of the head with the finger placed behind the trochanter head and neck (4) circumduction of the thigh to a position, in the ordinary case, of 90 degrees flexion and 90 degrees abduction. Gentleness is the thing upon which Denuce insists.

Of the 474 cases, 725 reductions, only 11 hips relapsed and of this number 9 hips were re-reduced successfully. Against this statement we must put that of Dr Galloway of Winnipeg who has abandoned the so-called "bloodless method" and operates on all by the open method. He reports as follows on 38 cases treated by open operation. "In 38 cases, operating by the anterior anterolateral route, or posterior route (Kocher) he cured 12 obtained good results in 14 failures in 6 and doubtful results in 6. In the cases he speaks of as cured not all the heads are in the acetabula, and they are far from anatomic cures. Under good results he includes those with stability and limited motion. Infection occurred in 6 out of the 50 operations.

Another group of statistics comprises 639 individuals with congenital dislocation of the hip—78 of these were boys and 561 of them were girls. Still other statistics show that of 713 cases, 224 were double dislocations, 201 were single of the right hip and 288 were single of the left hip.

In our series reviewed for the American Orthopedic Association, 286 cases have been studied, 369 hips. There have been 119 manipulative attempts, 65 by Dr Bradford's machine and 130 on the Hibbs table. 85 by the Lorenz stretching method, and 12 by open operation. The results show 266 hips reduced, 19 marginal, 2 anterior, 77 out, and 12 doubtful. The functional results of these patients are 149 good, and walking without limp, 67 fair walking with slight limp, 54 poor, 10 doubtful.

The roentgenograms before and at least three years after

that the good function, such as it is, will continue but where the head is on the ilium : *e.* posterior the support is ligamentous, and difficulty may follow an increase of body weight or a trauma injuring these ligaments. Certain of these cases, on account of the extreme lordosis, develop back strain as age and weight increase.

In unreduced cases there is noted at times in the roentgenogram an increased flaring of the ilia apparently giving somewhat more bony support. At times the roentgenogram shows an areola around the head, suggesting the formation of a bony socket on the outside of the ilium around the dislocated head. None of the postmortem specimens in the Warren Museum, however show any such socket. Furthermore, in 2 cases where an attempt to furnish such a shelf or socket by a bone-grafting operation has been made, no success was achieved. In one of these cases the graft from the tibia was wholly absorbed.

Fully realizing that the soft parts—*i. e.*, the muscles and their tendons, the capsule and ligaments, joint and bone cartilages, which do not show in the roentgenograms—may play an important rôle in the difficulties of reduction, we have made a study of the roentgenograms before reduction has been attempted, with a view to determining the best method of treatment and the ultimate prognosis as to final result.

Another point which is important to determine, from a comparison of the roentgenograms before and a number of years after treatment, is whether the anatomic changes in the heads and acetabula so common in these final results are due to congenital defects perhaps the cause of the dislocation, or to the trauma of reduction or to prolonged pressure on the growing epiphysis during the fixation in plaster.

The reports of failure and success from the various operators vary widely. Professor Maurice Denuce reports from the clinic at Bordeaux, France on 474 cases, comprising 725 hips, reduced by his method of manipulation, since the beginning of the War in August 1914. This method consists of (1) Flexing the thigh across the trunk, the knee being flexed and placed toward the opposite axilla. (2) pressure downward on the knee pushing

ing force to the cartilaginous capital epiphysis which force may be that exerted during reduction or subsequent holding in plaster. It is possibly a congenital defect. Some of the heads suggest that the epiphysis was loosened and slipped from its original attachment, and in some cases entirely knocked



Fig 260.—Case P Ray thirteen months after an easy machine reduction. Click as head bent into acetabulum. Note the changes in the head, neck, and acetabulum. After reduction the original plaster—extending from above the iliac crest to the toes (Large position, 90°-90° degrees)—was worn four months, and then changed to another exactly similar in same position. This was worn for four months more, then the legs were released from plaster. Child somewhat thin during last two months of holding, but grew some in height. Were these changes due to longitudinal pressure from the growing femora to the plaster capping the knees, or to trauma at time of reduction?

off and lost. These facts suggest that it would be a great advantage in our treatment to avoid the use of great force in reduction be that force exerted by the machine König's block—manual force.

It is the hope of the writer to stimulate the surgeons through-

reduction have been compared in 91 cases. In 71 the post operative roentgenograms alone were available. A very large proportion of the roentgenograms before reduction show small osseous centers in the epiphyses, torsion of the neck on the shaft which varies in its degree and shallow acetabula with a poor shelf. Of the postoperative roentgenograms, it is fair to say that only a few show normal bony contours of head and acetabulum.

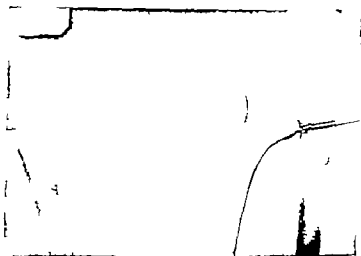


Fig. 159—Case P. Six years old. Double hips. Good epiphyses, but slight torsion. Fair acetabula. Machine reduction August 30, 1919. Lorenz position.

The torsion present before operation disappears in some of these cases after reduction without a corrective osteotomy but it persists in many especially in those with much deformity of the capital epiphysis. The most common defects are the thinned and flattened and often displaced capital epiphyses, and the rough, irregular imperfect acetabula. One may estimate the torsion, but it is impossible to gauge the result and the difficulties of reduction from an inspection of the preoperative roentgenogram. Many of the deformed heads suggest a crush-

ing force to the cartilaginous capital epiphysis which force may be that exerted during reduction or subsequent holding in plaster. It is possibly a congenital defect. Some of the heads suggest that the epiphysis was loosened and slipped from its original attachment, and, in some cases, entirely knocked



Fig. 260.—*Case P* Ray thirteen months after an easy machine reduction. Click as head cut into scrotulum. Note the changes in the head, neck, and acetabulum. After reduction the original plaster—extending from above the iliac crests to the toes (Lange position, 90-90 degrees)—was worn four months, and then changed to another exactly similar in same position. This was worn for four months more, then the legs were released from plaster. Child somewhat thin during last two months of holding, but grew some in height. Were these changes due to longitudinal pressure from the growing femora, to the plaster capping the knees, or to trauma at time of reduction?

off and lost. These facts suggest that it would be a great advantage in our treatment to avoid the use of great force in reduction be that force exerted by the machine, König's block or manual force.

It is the hope of the writer to stimulate the surgeons through

out this country to record more accurate data as to just what is done in every case and to record the end-results with accuracy as to the exact range of motion, shortening atrophy etc., with careful roentgenograms before and several years after reduction, to the end that we may improve our methods of treatment.

Congenital dislocations of the hip when under six, can all probably be successfully reduced with a normal, or nearly normal, functional result. Let us have your assistance in developing *this method*.

There is one departure from the ordinary practice which has been found useful. The usual roentgenogram taken after reduction to determine the position of the head is an anteroposterior view and even when stereoscopic this view may give an imperfect idea as to whether the head is in front of or behind the acetabulum. We have found extremely valuable another roentgenogram taken with the plate against the perineum at right angles to the plane of the plate, as it is ordinarily placed, the rays coming from the side at about the level of the axilla in the plane of the hip-joint and passing down more or less parallel with the outer face of the ilium. A little study enables interpretation, and shows the anteroposterior relation of head to socket. It has been proved possible to lock a head behind the socket, and also to place it anterior to the socket and have it appear in place in the ordinary roentgenogram.

CLINIC OF DR. MARK H. ROGERS

MASSACHUSETTS GENERAL HOSPITAL

TRAUMATIC OSTITIS OF THE WRIST

THESE 2 cases are presented for discussion because when they were first examined there was a good deal of uncertainty in regard to their true pathology and because it was quite evident that this condition is not very well known. Both cases presented symptoms of stiffness, pain, and disability of the wrist joint extending over a period of at least six months, and gradually increasing in severity. The onset was slow, the symptoms causing very slight inconvenience in the beginning, so that it was difficult to state when the first symptoms were noted. There was a definite history of trauma in one of the cases, but it was impossible to connect the trauma with the onset of the present trouble, while in the second case it was impossible to obtain any definite history of trauma.

Case L—J. T. Age twenty three. About nine months ago he began to complain of pain and stiffness of the right wrist after using it. At first the amount of discomfort was slight and did not prevent him from following his occupation as a mechanic. Later on he would have to stop work for a day or two, but after resting the joint would return to normal. Finally the pain and swelling increased so that he stopped work.

The examination showed a healthy young man with negative findings except the right wrist. There was a slight swelling over the dorsum of the wrist, no heat, no redness, slight tenderness to touch over the head of the radius and the scaphoid. The motions of the wrist were limited chiefly in extension to 15 degrees of the normal and any attempt to hyperextend caused pain.

The x-ray showed a normal wrist except as regards the scaphoid bone. The scaphoid shows a loss of substance of bone structure involving the central portion, with an irregularity and "crinkling" of the contour without any diminution in size and shape. There is no involvement of the contiguous carpal bones or the radius.



Fig. 261—Case I.

On careful questioning in regard to injury he states that about two years previous, while in service he sprained his wrist, and that it was treated by the application of tincture of iodine. There was no x-ray taken and evidently very little attention was paid to the injury. He used the wrist freely for a year although he states that it was weak and the present symptoms evidently developed after his discharge from the army.

Case II.—J B Age twenty five. He complains of stiffness and pain in the right wrist for the last six months. The onset was gradual, and now he is unable to continue his occupation regularly on account of the increase in pain on use. If he stops using the wrist the pain diminishes.



Fig 262.—Case II.

The examination is negative except for the wrist. There is very little swelling. There is tenderness over the head of the radius and the carpal bones. There is limitation of motion chiefly in hyperextension and attempts of full motion cause very definite pain.

We could not obtain any definite history of injury. He could not remember any time when he injured his wrist to such

an extent that he was compelled to stop work, although he did say that he had received minor injuries playing baseball. He did not connect an injury with the present condition.

The examination of the x-ray shows a lesion of the semi-lunar bone. It appears smaller than normal with a rather typical "crinkled" appearance and a change of the structure of the internal bony structures. There is no evidence of involvement of the contiguous bones.

The problem of diagnosis of these 2 cases is most important. Tuberculosis, syphilis, infectious arthritis, such as would occur from gonorrhea, and fracture were considered.

Before the x-ray was examined tuberculosis was certainly considered as very possible in both cases. The slow onset and the progressiveness of the disability pointed toward a tubercular process, and the possible slight traumatic history was not inconsistent with tuberculosis. In the first case the swelling was diffuse enough to make it possible that the whole wrist joint was involved.

In any peculiar bony lesion syphilis is always suspected. Nothing could be obtained from the history and the Wassermann reaction was negative in both cases.

The slow onset, the lack of involvement of other bones, and the lack of history of infection are against the diagnosis of infectious arthritis. It is not common for an infection to isolate one carpal bone except tuberculosis.

This brings us to the relation of trauma or fracture as a cause of such a condition. There has been described an absorption of bone as the result of a fracture of a cancellous bone such as a carpus. But a very careful examination of the histories of these 2 cases does not indicate that there had been a fracture, certainly not a transverse fracture. The first case did connect his injury received in service with his present condition but the second case put very little stress on his accidents although he probably did receive injuries playing baseball. In either case it does not seem probable that there had been a gross fracture.

The scaphoid in the first case and the semi-lunar in the second case were removed by operation because it was not possible to

control the symptoms by conservative methods. The first case had a thorough course of treatment for two months by physiotherapy and fixation, and the symptoms recurred on use. On incision there was no involvement of the capsule or neighboring joints as would be found in disease such as tuberculous or infectious arthritis. The surrounding tissues were normal and clean. The laboratory report was negative for tuberculosis.

This condition has been described in the literature a few times, but is not mentioned to any extent in the text-books. Kellogg Speed's book on Fractures and Dislocations calls attention to it in relation to fracture of the scaphoid. Preiser in 1910 reported 5 cases and calls it an osteitis as the result of trauma. He discussed the anatomy of the carpal bones and suggests that a slight trauma might shut off the nutrient artery and thus cause a secondary absorption of the bone. Guyé² in 1914 reports a similar condition, and explains it as primarily a compression fracture. These are the two best articles on the subject.

It is interesting to speculate as to the nature of this condition, which is evidently a clinical entity. In all probability there is an element of trauma the immediate effects of which are not noticeable and often overlooked. But the secondary effect is really the cause of the disability. There seems to be an absorption process which takes place gradually and this affects the cancellous portion rather than the articular surface. Preiser's explanation of injury to the blood-supply which causes the secondary changes is interesting and fairly convincing. We must also consider the theory that there has been an actual compression fracture with resulting secondary changes as put forth by Guyé. This last explanation seems to fit better if we can believe that a very slight injury can compress such a bone.

CLINIC OF DR. M. N. SMITH PETERSEN

MASSACHUSETTS GENERAL HOSPITAL

TUBERCULOSIS OF THE SACRO-ILIAC JOINT

TUBERCULOSIS of the sacro-iliac joint is generally looked upon as a chronic condition with a grave prognosis even with the most ideal treatment. By the most ideal treatment I mean recumbency in a plaster or leather back for a year or more, accompanied by heliotherapy and followed by brace treatment and gradually increasing activity. A case so treated would theoretically be well in the course of two years if no complications occurred. Abscess formation, however, is a very common complication resulting in chronic sinuses, secondary purulent osteomyelitis with frequently fatal outcome. Tuberculosis of the sacro-iliac joint is not a common condition. In the past three years only 8 cases have been diagnosed and treated at the Massachusetts General Hospital Orthopedic Department.

Tuberculosis does not thrive where there is no motion; this gives us the clue to our treatment of tuberculous joints. In children where the time element is of comparatively little importance and where we are dealing with epiphyses, conservative brace or plaster treatment carried on for years sometimes results in joints with limited motion. In adults, where the time element is of supreme importance and where epiphyses and growth do not come into consideration any procedure is justifiable which will shorten the duration of treatment and result in a functionally good extremity. Excision of the knee and arthrodesis of the hip are examples of such operative procedures used with good success. Arthrodesis of the sacro-iliac joint for tuberculosis, as far as known to the author, has not been described in medical literature. The chief reason is

probably that the joint is so situated that it is not easily accessible except by very destructive operations. During the past three years an approach has been used by the author with uniformly good results in the treatment of tuberculosis of the sacro-iliac joint. (Reported before the meeting of the American Orthopedic Association, 1921.)

This operation consists in a subperiosteal reflection of a flap from the posterior two-thirds of the ilium down to the sacro-sciatic notch, exposing its lateral surface. A rectangular window is then chiseled through the ilium just above the sacrosciatic notch *i. e.* within the projected sacro-iliac joint area. On removing this window the sacro-iliac joint surface comes into view and the greater part of its diseased portion may be removed. By replacing the block of bone removed from the ilium a dowel is formed across the joint which favors an early ankylosis. The flap is turned back in place and the incision closed in layers, without drainage.

Seven cases of tuberculosis and 6 cases of relaxed sacro-iliac joint have been treated by the above method of arthrodesis with gratifying results. The following case is a fair example of tuberculosis of the sacro-iliac joint so treated.

A. R. S. Age seventeen.

November 20 1918

Occupation—Lacer shoe factory

Family History—No history of tuberculosis or known exposure

Past History—Positive findings have no bearing on present illness.

Present Illness—Four months ago while riding a bicycle patient fell, striking right hip. Since that time there has been persistent pain in the region of the right hip at times very acute. There has been decided right-sided limp since the injury.

Physical Examination—Young boy in poor physical condition, moving about evidently in great physical pain. Other wise general physical examination negative.

Local Examination—Hip motions internal and external

rotation free in extension in flexion rotation of the left, free, not accompanied by pain on the right markedly limited by muscle spasm and pain. Straight leg raising limited to 45 degrees, both sides by pain and muscle spasm. Motions of the spine limited in all directions by muscle spasm and pain referred to the right gluteal region.

Rectal Examination—Marked sensitiveness on the right side as compared with the left some evidence of fulness in the region of the right sacro-iliac.

Stereoscopic x-rays taken of the low lumbar spine, sacrum and sacro-iliac synchondroses. The right sacro-iliac synchondrosis in its lower portion shows a moth-eaten appearance with atrophy of the bone particularly on the sacral side starting at the lower portion and extending upward about 1 inch. The left sacro-iliac synchondrosis seems normal. The irregularity and atrophy of the bone is very suggestive of a tubercular arthritis. The fifth lumbar seems normal (Fig 263)

Treatment—On the basis of clinical findings and x-rays arthrodesis was advised but patient failed to enter hospital until February 1 1919. At that time there had been distinct improvement in the local condition but pain still persisted and arthrodesis was performed.

Operation February 7 1919—Approach as above described. On reflecting the flap just above the sacrosciatic notch a tuberculous abscess was encountered. This was evacuated and packed with gauze sponge. A window was then cut through the ilium into the sacro-iliac joint, which was found to be extensively destroyed, the process involving even the posterior sacro-iliac ligaments. As a result of this extensive destruction there was abnormal mobility of the joint, so that it opened and shut like a book synchronous with the respiratory movements. As much of the diseased portion of the joint and surrounding bone was removed as could be reached. The window was not replaced as it was thought that it might form a foreign body in the mass of tuberculous tissue. The wound was closed in layers no drainage. Double plaster spica applied.

Pathologic report of tissues removed from sacro-iliac joint

Irregular fragments of bone showing on microscopic examination, atrophy of the trabeculae with *fibrosis* and *small round-cell*



Fig. 263.—November 22, 1918. Ray three months before operation (M. G. H.).

Stereoscopic plates taken of the low lumbar spine, sacrum, and sacro-iliac synchondroses. The right sacro-iliac synchondrosis in its lower portion shows moth-eaten appearance with atrophy of the bone particularly on the sacral side starting at the lower portion and extending upward about 1 inch. The left sacro-iliac synchondrosis seems normal. The irregularity and atrophy of the bone is very suggestive of metastatic arthritis. The fifth lumbar seems normal.

Infiltration of the marrow. There is a rare focal collection of epithelioid and giant-cells.

Postoperative History—Convalescence was uneventful up to March 2d on this date a superficial sinus was found in the line of the incision. As time went on others formed. They were treated by dichloramin-T and gradually cleaned up



Fig. 264—April 2, 1919 Ray two months after operation (M. G. H.)

Plate taken shows an area where the bone was removed in the ilium just in from the posterior spine there is slight erosion on the lower portion of the sacro-iliac synchondrosis.

x R Taken April 2d—Plate taken shows an area where the bone was removed in the ilium just in from the posterior spine there is slight erosion on the lower portion of the sacro-iliac synchondrosis (Fig. 264)

On May 1st patient was discharged with a small dry dressing and a webbing belt. During the following months activity was gradually increased. Sinuses closed entirely and have not



Fig. 261.—January 22, 1921. Ray taken three years after operation. There is an opening in the site of operation. The edges of the bone apparently healed. There is slight irregularity on the very lower portion of the sacro-iliac synchondrosis. Below this the area is normal and here fusion of the sacro-iliac articulation has evidently taken place adjacent to this area.

recurred, nor has there been any recurrence of pain or tenderness in the region of the joint or the operative field.

Through the aid of the Massachusetts General Hospital

Social Service Department the boy was financed through a course of wireless telegraphy and is now a licensed wireless telegrapher. His general condition is excellent his local condition leaves nothing to be desired.

x Ray Taken January 2, 1921—There is an opening at the site of operation with the edges of the bone apparently healed. There is a slight irregularity on the very lower portion of the sacro-iliac synchondroses above, the area is normal and there is fusion of the sacro-iliac articulation immediately adjacent to this area (Fig 265)

Dr L. B. Morrison of Boston, has been good enough to interpret the x-rays so that an unprejudiced opinion might be obtained.

CLINIC OF DR. PHILIP D WILSON

MASSACHUSETTS GENERAL HOSPITAL

THE SYME AMPUTATION

D W MALE aged thirty-nine, and a farmer by occupation was admitted to the Massachusetts General Hospital March 1 1920 (Record No Orth. 235 409) because of pain and swelling in the left foot. The family history was negative for tuberculosis and the patient had always been well and strong except for the trouble from which he is now seeking relief. He is unmarried and denies syphilitic infection both by name and symptoms.

He states that at the age of twelve inflammation developed in the forepart of the left foot which was called 'perostitis'. This illness was so long ago and he was so young at the time that he can recall little about it except that the foot was in a plaster cast for two years and that after the cast was removed an abscess developed and ruptured spontaneously. There was a discharging sinus for seven years, but he used the foot actively during this period. From then until about two years ago the foot caused no trouble save that two or three times an abscess developed in the same locality as the original one, which after rupturing healed in a short time and caused but little interference with function. The last time this occurred was about five years ago.

Two years ago the left foot was injured by a log rolling on it. It was so swollen and painful that he stayed in bed for two days. He then resumed work, but after three weeks the pain increased to such an extent that he came to the Out-patient Department of the Massachusetts General Hospital for treatment. Here the foot was immobilized in plaster for several

months and then became so much better that he could walk on it. Several months later he sprained his foot, with recurrence of the pain. The trouble continued with alternating periods of exacerbation and improvement until five months ago since when it has been growing definitely worse, and the foot has become hot, red, and swollen.

Examination of the patient was negative, save for the left foot. This was considerably swollen, but most markedly so over the region at the base of the fourth and fifth metatarsals and over the cuboid. There was marked tenderness on pressure over this area on the dorsum of the foot less marked on the plantar surface. There was slight heat, but no redness, slight bony thickening and all the motions of the foot seemed free, except for the limitation caused by pain.

The radiogram showed an area of lessened density due to a destructive process involving the cuboid, cuneiforms, and the proximal portions of the third, fourth, and fifth metatarsal bones. When compared with a radiogram made two years previously it showed considerable extension of the disease.

In view of the long history and the definite inflammatory character of the lesion the differential diagnosis rested between three types of bone infection—tuberculosis, syphilis, and chronic osteomyelitis. The Wassermann reaction had been tried on three occasions and was always negative. This, with absence of history of personal or family infection, seemed to rule out syphilis. The normal temperature and the failure of the radiogram to show sequestra or proliferative changes in the bone characteristic of osteomyelitis pointed against the latter. This left tuberculosis as the final diagnosis, and in favor of it were the long latent character of the lesion, the purely destructive nature of the bony changes, and a strongly positive Von Pirquet skin tuberculin reaction, although too much consideration should not be accorded the latter.

The involvement of practically the entire distal row of the tarsal bones as well as portions of the outer three metatarsals precluded any attempt at a conservative operation. The resulting foot would have been functionally useless and infinitely

less desirable than a modern artificial one. Radical removal of the disease was indicated and amputation was the only procedure that would accomplish it.

This raises an important question which frequently confronts the surgeon. What is the best level for amputation of the leg when the lesion which necessitates radical removal is confined to the bones or other tissues of the foot? Happily the time has almost completely passed when this question received its answer. By amputation at a point 4 inches below the knee or at the traditional "seat of election." It was only the war with its thousands of amputations that revealed the ignorance in which our profession rested with respect to artificial limbs. The seat of election dates from the time of the bent knee peg leg when a long stump projecting behind constituted an unsightly and disgraceful monument to bad surgery and yet it will be found advocated in all but the very recent text-books of surgery.

The war showed the surgeon the necessity of exchanging ideas with the limb maker and at the same time provided a rich field for the study of end-results. The comparative value of amputations at different levels has been definitely established, and every surgeon must acquire this knowledge because it is of the greatest practical importance to future patients.

A great variety of foot amputations have been described, the best known being the Lisfranc, the Chopart, the Pirogoff and the Syme. All have been designed as substitutes for amputation of the leg. Let us now consider how well they achieve this purpose.

In the first place it should be stated that amputation through the leg when properly performed gives a result in itself excellent. The best level is at a point 8 inches below the knee. This represents the consensus of opinion expressed at a meeting of the Association of Artificial Limb Makers held at Washington during the war. Weight bearing is primarily upon the shelving under surface of the bony prominences at the top of the tibia, secondarily upon the conically shaped soft parts of the stump. Weight bearing at the end of the stump is of little value and

seldom utilized. A stump of this length has good leverage power and is readily fitted by any limb maker. The leg is of willow and weighs about 5 pounds. The disability from this amputation is rated in the army at 40 to 50 per cent. but is usually much less. All except heavy laboring work can be done almost as well as before amputation. The chief difficulty comes from callous spots that develop at the chief bearing points. Walking is apt to be more difficult in hot weather when the stump which is badly ventilated, perspires freely and the resulting moisture causes chafing of the skin.

The Lisfranc amputation or disarticulation at the tarso-metatarsal junction with long plantar flap gives a foot that is quite satisfactory for weight bearing and which requires for apparatus only an ordinary shoe with the toe stuffed with felt. Unfortunately its practical value is small, because it can only be used in cases where the disease or injury is confined to the extreme forefoot. The former cases are rare while the latter although common enough, are unsuitable because the plantar surface is usually involved in the injury and a healthy plantar flap is the *sine qua non* of a successful result.

The Chopart amputation or disarticulation through the mid-tarsal region gives an unsatisfactory result in almost every instance and ought to be abandoned. This operation destroys the muscle balance of the foot, with the result that the heel draws up and the foot rolls inward producing a position of equinovarus. The weight is borne directly on the forward angle of the stump and is commonly painful, while the foot is also unstable laterally. It is impossible to fit any appliance that makes the result more satisfactory while tenotomy of the tendo achillis and arthrodesis of the subastragaloid joint improve, but do not entirely correct the condition. The final disability is commonly greater than with amputation through the middle of the leg.

The Pirogoff amputation has been little practised in this country but at one time had a great vogue in Europe. It is, in reality a modification of the Syme and consists in amputation of the leg just above the malleoli with preservation of a

long plantar flap and implantation of the posterior portion of the os calcis on the ends of the cut bones. When it succeeds this gives a stump that is capable of direct end-weight bearing but in a fairly large percentage of cases non-union of the transplanted portion of bone occurs, with resulting failure. The chief difficulty however lies in the fact that the stump is too long. There is a certain minimum requirement of room necessary for providing a satisfactory ankle-joint mechanism, and the distance between the end of the stump and the ground in this instance is insufficient.

Of the host of other partial foot amputations which have been suggested nothing further need be said the oblivion in which they rest is the best indication of their complexity and lack of success.

There remains, however one procedure to be considered, the very great value of which has been conclusively proved by war experience. This is the supramalleolar amputation by the classical method of Syme.

It was first described by Sir James Syme of Edinburgh, in 1843 and was intended as a substitute for amputation of the leg in the radical treatment of tuberculosis involving the tarsus or ankle-joint. In those pre-Listerian days amputation of the leg was an operation attended by a high mortality and the new procedure carried less risk and gave a better result than could be obtained with the kneeling peg-leg. The discovery of the cause of wound infection and its elimination from surgery came before the Syme operation was widely known. Amputation of the leg recovered its vogue, and this was still further stimulated by the excellent results obtained with the new type of artificial leg. In the complete absence of comparative end-result studies it is of little wonder that the surgeon followed the path of least resistance and that the procedure of Syme was gradually forgotten everywhere except in the country of its inventor.

The chief merits of the operation are 1 That it provides a stump capable of transmitting the entire body weight to the ground by direct end pressure without pain.

2. That it removes only the foot, and therefore leaves a stump of the greatest leverage power

3. That it is less crippling than the common amputation of the leg. There is less sense of mutilation, because the patient is independent of his apparatus and can walk about his room on the bare stump, a convenience of great importance on many occasions.

The chief disadvantages are that the stump is bulbous, which makes the appearance of the ankle thick and unsightly when the apparatus is worn, and that the legs supplied by the artificial limb makers are heavy and clumsy. My reply to these objections is that when the operation is properly performed the stump is not markedly bulbous and that it is comparatively easy to construct a leg that meets not only the cosmetic difficulty but answers all other requirements admirably. The disability that results from a good Syme amputation, equipped with suitable appliance is so slight that the patient is able to resume any occupation, no matter how laborious. There are numerous instances on record of men who have participated in long tramping trips, marched in full equipment with troops, and engaged in other kinds of difficult labor without their comrades being aware of their infirmity. The evidence justifies the statement that where the Syme amputation meets the indications it is to be preferred in all instances to amputation of the leg.

In the case mentioned above the Syme amputation met all the requirements. It allowed radical removal of the disease and yet permitted the hope of eventual return of the patient to his farming occupation, which amputation at a higher level precluded.

Two factors are essential for the success of the Syme amputation, both of which were present in this instance.

1. The skin covering the bottom of the heel must be healthy and undamaged.

2. Acute sepsis and foul sinuses neighboring the operative field must be absent in order to prevent contamination of the wound. Wound infection practically always causes failure.

Accordingly the patient was advised to submit to the Syme

amputation. He consented readily as his mind had been prepared for the loss of the entire leg.

The operation was performed March 4, 1920, under ether anesthesia. The patient made an uneventful recovery and was discharged March 25th, with his wound entirely healed and walking on a temporary peg leg. At the end of two months he was fitted with his permanent limb and returned to his home. Only recently I received word that he is working as a farm laborer and apparently as active as ever.



Fig. 266

As the technic of the operation and after treatment are important a detailed account of them is given.

Operation—A tourniquet is always used. The forepart of the foot is grasped by the left hand and traction exerted on it in a forward and downward direction during the entire first stage of the operation, that is, until the complete removal of the foot. This greatly facilitates the operation and makes assistance almost unnecessary.

A straight incision is made extending from the tip of the

external malleolus directly downward and across the plantar surface, then up the medial surface of the ankle, terminating $\frac{1}{2}$ inch below the tip of the internal malleolus. The two upper ends of this incision are then connected by a slightly curved incision with the convexity upward running across the dorsum of the foot just below the level of the articular surface of the tibia. This incision opens the tibioastragaloid joint across its entire width. The knife is then inserted in the joint and the



Fig. 267

external and internal lateral ligaments divided, which allows the foot to be displaced forward and downward (Fig. 267). This exposes the posterior capsular ligaments which are cut close to their insertion in the astragalus, and the dissection carried backward and downward over the top and posterior portion of the os calcis, keeping in as close proximity to the bony surface as possible (Fig. 268). The tendo achillis is divided at its insertion and the entire foot finally freed and removed from the leg, leaving only the posterior heel flap

The next step is to free the upper flap by dissecting away the tissues covering the lower ends of the tibia and fibula (Fig 269) This flap is then retracted and the articular surfaces, including the two malleoli removed with the saw (Fig 270) It is important to apply the saw at an exact right angle to the axis of the limb otherwise a sloping surface results and the weight is borne too much on one point for comfort. The bones should be sectioned high enough to obtain the smallest possible



Fig 268.

diameter of bony surface, and yet low enough to pass through a point where they are still in close contact and held firmly together by the tibiofibular ligaments. This reduces the size of the end of the stump and improves the cosmetic result. This level corresponds to a point about $\frac{1}{2}$ inch above the articular margin.

I am firmly convinced of the utility of the aperiosteal method of treating the bone ends in order to prevent spur formation, and am in the habit of applying it in all clean amputations.

By this method the bones are denuded of a cuff of periosteum $\frac{1}{4}$ inch wide at their distal extremity. The sharp bony edge is then rounded off with a rasp.



Fig. 269

The principal nerves, consisting of the posterior tibial musculocutaneous and lateral cutaneous, are now identified, pulled down, and sectioned after previous injection with 95 per cent. alcohol, which Hilber has shown is the surest method at our disposal for preventing the development of neuromata.

The projecting tendon ends are trimmed away the vessels ligated, the tourniquet removed and all bleeding checked.

We now come to one of the most important parts of the operation—the closure. One of the chief reasons for failure of the operation in the past is that the terminal flap is left too



Fig. 270.

redundant, with the result that it rolls under the stump in bearing weight, thereby causing instability. This fault also makes fitting of the appliance more difficult. It can be avoided by careful plastic closure of the skin, trimming away all superfluous tissue in order to make the flap fit firmly (Fig. 271)

Especial care should be paid to the removal of projecting tabs at the angles of the wound (Fig. 272)

Throughout the entire operation great care must be taken to avoid injury to the posterior tibial artery as it descends behind the internal malleolus and the mesial side of the ankle. The heel flap is dependent for its blood-supply on the internal calcaneal branch of the posterior tibial artery which is given



Fig. 271.

off just before the latter bifurcates into the internal and external plantar vessels, at a point about 1 inch directly below the tip of the internal malleolus. If the artery is cut above this point the edge of the plantar flap sloughs over an area nearly an inch wide, with distressing delay in wound healing. This accident may be prevented by making the original incision according to the directions given above and keeping the dissection on the

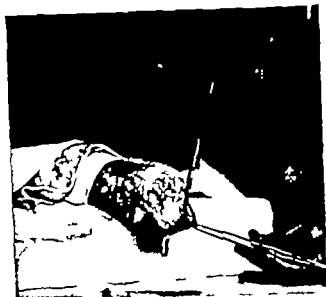


Fig. 272.



Fig. 273.

mesial side of the ankle as close as possible to the bone. The danger involved in trimming away tissue from the mesial aspect of the heel flap in order to obtain more perfect closure may be removed by separating the skin from the underlying fascia



Fig. 274



Fig. 275.—Synovial strap with redundant cranial flap. Weight bearing ability is good, but cosmetic result poor. Requires large claustrum appliance.

and confining the plastic work to the skin. The vessels lie below the fascia and may be infolded without harm in approximating the skin margins.

Closure is by interrupted silk sutures and careful approximation should be obtained. Drainage is provided by folded



Fig. 276.—Type of appliance fitted preceding stump. Ankle is straightly and requires modification of the upper part of the shoe.

rubber tissue passing through a stab opening in the posterior portion of the heel flap. The suture line in front should be above the cut margin of the bone (Figs. 273-274).

The wound is covered with a small quantity of dry sterile

gauze, and a sterile bandage soaked in alcohol is applied as tightly as possible over this. The bandage can be applied more tightly when wet, and the alcohol evaporates rapidly. Provision should be made for the removal of the drain without necessitating disturbance of the bandage. The leg should be elevated when the patient is placed in bed.



Fig. 277.—Good Syne stump. Very little terminal enlargement, and close-fitting cap. Shows also the temporary plaster peg-leg used in this case.

The drain is removed in forty-eight hours and the stitches at the end of twelve days. At this time the stump is strapped securely with strips of adhesive plaster.

At the end of fourteen days the patient is ready to begin weight bearing. A temporary peg-leg is then made in the following manner. A plaster cast is applied to the stump extending upward to just below the knee. Two pieces of strap iron

$\frac{1}{4}$ inch wide and $\frac{1}{4}$ inch thick bent to conform to the mesial and lateral surfaces of the cast, are applied and fixed in this position by additional turns of plaster bandage, with their lower ends projecting about 3 inches below the end of the cast. When the cast has hardened the anterior portion is cut out and the stump withdrawn. A block of wood of the proper length



Fig. 278.—Same patient standing in his plaster appliance. All the body weight is being borne on the end of the stump.

to compensate for the portion of the limb removed is then fitted between the projecting ends of the iron bars and fixed by screws passed through holes drilled in the latter.

The patient quickly learns to walk about in this leg, which is held in place by buckle straps or bandage. As the end of the stump develops in ability to bear weight successive layers

of felt are inserted in the bottom of the cast until finally the entire weight is being borne in this manner.

At the end of two months of active use of the temporary leg the patient is usually ready for the application of his permanent limb. The leg developed at the Army Orthopedic Hospital at Toronto, Canada, is the most satisfactory type of apparatus I know and answers every requirement. Through the kindness of Colonel Starr I obtained the mechanical drawings of this leg.

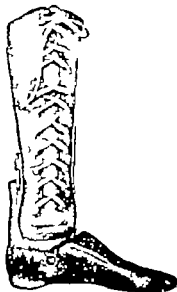


Fig. 279.—Canadian type of artificial limb for Sympa amputation. (Photograph of Col. C. L. Starr.)

and am now using it instead of the ordinary leg with wooden socket. The socket is made of heavy cowhide molded over a plaster model of the stump. It is reinforced with tempered steel bands on its anterior and posterior surfaces, and these are connected to the wooden foot by means of a simple ankle mechanism. The apparatus combines the qualities of lightness, simplicity and meets the cosmetic objection better than any leg I have seen.

CLINIC OF DR. RAFE N HATT

MASSACHUSETTS GENERAL HOSPITAL

SPASTIC PARALYSIS

NEUROTOMY (STOFFEL OPERATION) AS A METHOD OF TREATMENT

THE term *spastic paralysis*, as generally used conveys the idea of the various pareses of congenital origin. By more liberal interpretation however it denotes a condition of spasticity irrespective of etiologic factors. This latter conception obtains in the following discussion.

Restoration of power balance and correction of deformity are the indications for surgical intervention in the treatment of spastic paralysis. These indications are obviously identical to those governing the operative treatment of the flaccid paralysis most commonly associated with anterior poliomyelitis. This is not strange for while the one represents the physiologic antithesis of the other in so far as the muscular element is concerned, the ultimate underlying processes are similar namely a loss of voluntary control destruction of power balance, with deformity as the concomitant result.

The loss of voluntary control in both types of paralysis is due to a break-down in the neuromuscular mechanism. The determining difference between the two lies in the anatomic localization of the break. In the spastic type the regulator apparatus (suprasegmental neurone) is damaged and the motor or effector part remains intact from a histologic point of view. The condition is a paresis. In the flaccid type the effector part is the site of injury (segmental neurone plus muscle). There is a disintegration of the motor itself—a true paralysis.

This bit of elementary neurology contains the fundamentals for rational surgical procedure. The paralyzed muscle must be

attacked directly. If contracted it must be lengthened. If its function is of sufficient importance, it may be replaced by another muscle, or even the part which it normally helps to control may require stabilization by arthrodesis, splinting, etc. Before taking up the question of treatment in spastic paralysis it may be well to consider certain definite *anatomical-pathologic* aspects, although the general pathology is too familiar to merit discussion here.

1 Spastic paralysis results from lesions of the *suprasegmental* or *upper motor neurone*. Such lesions may be classified briefly as

- (a) Congenital—"Little's disease."
- (b) Tumors.
- (c) Disease—sclerosis, myelitis, etc.
- (d) Traumatic—fractures, etc.

2 The reflex arc is unimpaired.

3 The condition is a *paresis*—not a paralysis.

4 Spasticity represents a state of muscle hypertonus due to impairment of cortical inhibitory control, as evidenced by a *lowering of the reflex threshold to stimulation*.

5 Deformities are the result of the spastic exaggeration of the physiologic predominance of certain muscle groups over their antagonists. Rarely is it due to a true fibrous contraction.

6 A muscle is an aggregation of fibers, and each of these fibers receives a nerve process. Thus, a muscle may be said to represent so many neuromuscular units, and an approximation of their value may be mathematically expressed.

A conception of logical treatment now follows. To repair the regulator apparatus would be ideal. Unfortunately however it is not possible. Since the reflex threshold cannot be raised in this manner the remaining proposition is to diminish stimulation—a matter of no great difficulty through accessibility of the reflex arc. Two methods of surgical approach are available. Posterior rhizotomy—Foerster's operation neurotomy of the peripheral nerve—Stoffel's operation.

The anatomic basis for the latter operation was developed by Adolph Stoffel in 1909 following a survey of end-results in treated congenital cases. Stoffel was impressed with the

frequent failures of customary measures myotomy tenotomy transplantation etc., and sought a means that might yield a more permanently satisfactory result. An investigation of the large peripheral nerve trunks revealed a cable-like structure which permitted isolation of the various funiculi prior to their emergence as individual muscle or sensory branches.

Stoffel charted many of the larger trunks with a moderate degree of accuracy. The "nerve pattern, as he termed the arrangement of funiculi within the cable, is not invariable, as Stoffel at first supposed, but it shows no greater variation than one encounters in the muscles, and infinitely less than one finds in the case of arteries. The relations are, therefore, sufficiently constant to meet the demands of precise surgical measures. Personal observation on dissecting-room material during the past three years with investigation of nearly 100 subjects, has been in accordance with this statement. Further more, it is significant that nearly all late reports on nerve suture recognize the utility of the nerve pattern.

The operation consists in exposure of the nerve trunk at a convenient level. The nerve sheath is carefully divided with meticulous regard for hemostasis. With small forceps, or a Moll dissector the funiculi to be resected are isolated from neighboring bundles. Bearing in mind the delicate structure of axis-cylinders, one hardly need be cautioned to avoid rough handling stretching, or crushing with forceps during this step. It is true that nerve tissue will withstand considerable insult, but since in most cases results depend in no little degree upon deliberate quantitative destruction, it is well to leave as little as possible to hazard. When doubt exists as to the identity of the funiculus, stimulation by means of a weak electric current produces contraction of the muscle supplied. The current must be nearly minimal, since strong stimulation overflows and may lead to error. Having freed the funiculus for 3 or 4 cm., a portion is resected. The amount to be destroyed depends upon the following factors

1. The degree of spasticity
2. The state of the antagonist.

3 An estimation of the neuromuscular units. (The size of a muscle nerve is directly proportional to the number of muscle fibers. Hence, a muscle small in bulk, but of fine structure, *e. g.* the flexors of the fingers, has a relatively larger supply of nerves than another muscle many times its size, but of coarse texture, *e. g.* the glutes. Therefore, no set rules can be form-

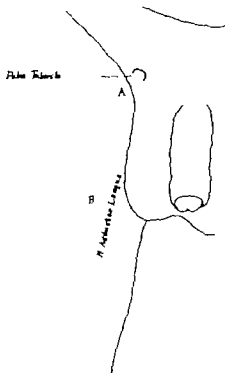


Fig. 280. -A-B Line of skin incision for exposure of N. obturator

lated from these variants, but the matter must rest upon the experience of the operator and his exact anatomic knowledge.) The proximal stump of the resected segment may be transplanted to the superficial fascia to obviate the possibility of regeneration. The sheath is repaired, the wound closed, and ordinary sterile dressing applied. Immobilization or restrictive

dressings are inadvisable, owing to a temporary general increase in spasticity from the operative trauma. Held in restrictive dressings, this temporary aggravation sets up a cycle of stimulation and reaction which causes great discomfort and prolongs the postoperative convalescence. The period of reflex activity subsides within a short interval and active physiotherapy should

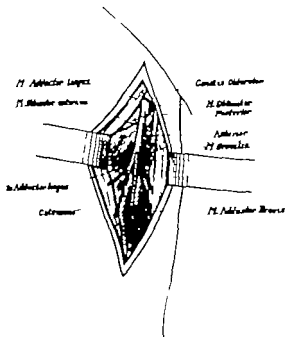


Fig. 281.—Exposure of N. obturator (semidiagrammatic). The M. M. adductor longus and pectineus are retracted laterally. Stippled portion represents the section removed at operation.

Immediately follow. The operation does not effect a cure in the same sense as an appendectomy or herniotomy but bears a close relation in this respect to the tendon transplantations in treatment of flaccid paralysis. The real value in both cases lies in rendering the part more susceptible to effective after treatment in shortening the period of after-treatment, or both. Co-ordinate muscle action is the chief objective in after-treat

ment. Light massage electric stimulation, and muscle training are carried on with this aim in view great care being observed to avoid overstimulation or fatigue. Correction of deformity and protection of the overstretched muscles are maintained by light, easily removed splints.

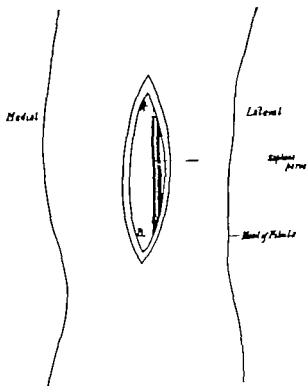


Fig. 252.—Skin incision for exposure of λ tibial at popliteal fossa. A-B Line of incision in popliteal fascia.

Poor or unsatisfactory results may be credited to

1. Type of patient—low mentality, marked athetosis, diffuse spasm, progressive disease.
2. Operative—technic and failure to properly estimate the quantitative factors.

The operation as applied to treatment of congenital cases has been well covered by Stoffel, Bundschuh, Bucholz, Gill, *et al*. The following case is cited as illustrative of its application to spasticity in adults due to causes other than congenital.

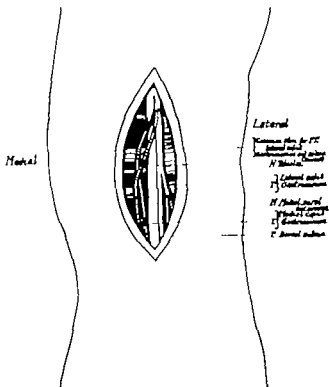


Fig 213—Exposure of N tibial (semidiagrammatic) + popliteal fossa. With common arrangement of tend to M. M gastrocnemius and soleus (dorsal)

The patient, a male, aged twenty-nine, occupation sailor came to the clinic complaining of stiffness of the right leg and difficulty in walking. His family history and past history were unimportant clinically. His present trouble dates back to ten years ago when his back was fractured in the lower thoracic region by a fall into the cargo hold of a vessel. He

thinks he did not lose consciousness, but was unable to stand and there was no feeling below the hips. He was treated in a Rotterdam hospital for eleven weeks by extension on a water bed. Sensation began to return during the first week. After six weeks he could move the toes of both feet, and a plaster jacket was applied in the eleventh week. Subsequently the left leg improved rapidly and he gained practically complete control on that side. The right, however showed very little improvement. In all, his early treatment seems to have covered a period of three or four years. Recently he has held a position aboard ship as an assistant steward. The duties performed are chiefly those of a second cook, but falls are frequent, and even the moderate activity demanded by the work is very fatiguing. The outstanding feature in the physical examination was his gait. The right lower extremity was partially flexed at the hip markedly adducted, and the foot was in equinovarus. Ankle-clonus was set up at each step and he was forced to swing the left leg around the adducted right leg. The spine showed a rounded kyphos in the region of the eleventh and twelfth thoracic vertebrae and a sharp lordosis in the lumbar region. The x-ray diagnosis was "An old fracture of the twelfth thoracic and third lumbar vertebrae." The reflexes of the lower extremities were spastic in character. No sensory disturbances were noted. The neurologic consultant gave the following opinion: "Originally a hematomyelia with cord injury at the twelfth dorsal and first lumbar segments, probably. Prognosis: Permanent condition as exists at present. No treatment advised unless some peripheral means are indicated. The blood Wassermann was repeatedly negative. Operative indications in this case were to correct the adduction and equinovarus deformities by restoring power balance in the affected muscle group.

Operation, September 22, 1920. Under ether anesthesia the anterior ramus of the obturator nerve was divided 3 cm. from the obturator canal. The tibial nerve was exposed at the popliteal space and approximately two-thirds cross-section was resected from the funiculi to the gastrocnemius; the dorsal funiculus to the soleus completely resected; the funiculus to the

tibiae posterior was resected to one-half cross-section. Surgical recovery uneventful.

At the end of a week a fair range of voluntary abduction of the thigh and dorsal flexion and abduction of the foot were possible. The patient was discharged from the hospital on the eighth day following operation, and nine days later secured a position in the hospital as ward attendant. The improvement in his gait was quite remarkable. Some time later he reported with a painful knee. Examination at this time brought up the question of correcting the hip flexion. Accordingly he was returned to the ward, and operation performed on December 8th. The psoas is not accessible to neurotomy. Therefore the fibers were raised from their insertion, through a posterior incision, splitting the gluteus maximus and quadratus femoris. Twelve days later the patient was discharged to the Out-patient Department, where he has been under observation at frequent intervals up to the present time. Active abduction is two-thirds normal in degree, adduction normal, flexion and extension free, but carried out rather stiffly. The position of the foot is normal. He is now able to walk a mile or more without fatigue, and has been employed as a fireman at one of the hospital buildings. He intends to return aboard ship as a seaman at the cessation of current labor troubles.

Conclusion —Although this case does not represent an end-result, the immediate effect of the operations is favorable. The case illustrates the extremely short hospital convalescent period. It seems fair to infer that cases of this type offer a field for neurotomy.

Note —A detailed clinical record of the above case has been accepted for publication by the Boston Medical and Surgical Journal.

CLINIC OF DR JOHN HOMANS

PETER BENT BRIGHAM HOSPITAL

THE SYMPTOMATOLOGY OF CARCINOMA OF THE LARGE INTESTINE

Th Cecum; the Ascending Colon the Transverse Colon; the Descending Colon; the Sigmoid Flexure; the Rectosigmoid junction; Summary; Illustrative Cases; Tables, etc.

THE present status of the treatment of malignant disease of the large bowel fairly represents on the one hand the failure, and on the other the real progress of the medical profession in the fight against cancer. It is perhaps putting the matter too strongly to say that surgery has obtained an ascendancy over any particular form of malignancy but evidence is beginning to accumulate that surface carcinoma, as for instance of the breast and cervix uteri, may be cured by operation in a proportion as high as 50 per cent. even in unselected series of large clinics. That any such figures, though only for accessible or visible cancer are deceptive is well known to both general practitioner and surgeon since many patients are seen for the first time by the former only when palpation alone is possible, or can only be persuaded to see the latter when a radical cure is equally hopeless. Nevertheless, through the education of the public, the general practitioner and the surgeon, real progress in the treatment of surface growths is constantly being made as contrasted with the apparent hopelessness of malignant disease inaccessible to external examination. Into this latter category fall cancers of the esophagus, the stomach the intestine in general and the prostate.

While it is true that in the case of the stomach malignancy superimposed on ulcer and discovered in operations performed

From the Surgical Clinic of the Peter Bent Brigham Hospital, Boston.

for ulcer is quite curable, cancer well developed enough to be recognizable as such is rarely cured. In the same way cancer found by *microscopic examination* of an innocent appearing prostate may be cured while outspoken cancer cannot. In other words, the concealed carcinoma, by the time it gives symptoms as a tumor offers very little opportunity for curative removal. There is, however reason to believe that in some directions better results are not only possible but probable, and I wish particularly to speak of cancer of the large intestine, leaving aside the rectum (a field theoretically more favorable) Dr W J Mayo¹ is able to show that by increasing boldness and skill in attacking growths of the large bowel the percentage of patients cured has been notably increased even though the operative mortality as well has been raised. Further progress in this field is to be expected and may well be made not only by greater operative skill on the part of the surgeon, but even more perhaps by a more prompt interpretation of symptoms by patients and physicians.

The results of an investigation in this clinic into the early symptoms of cancer of the colon have proved sufficiently striking to warrant the belief that though the symptoms of large intestine cancer may be well known to those having a large experience in this field, they are not being generally taught or published. More particularly has it been evident that the symptoms have a considerable variation in accordance with the portion of the large intestine invaded by the growth.

Sixty-one patients with cancer of the large intestine, exclusive of the rectum have been treated on the Surgical Service at the Peter Bent Brigham Hospital from 1913 to 1920 inclusive. Operations have been performed upon all but 2. In grouping these cases it is apparent that cancer has occurred most often in the sigmoid, and that the transverse colon and cecum are the next favorite locations. Beginning at the upper end of the colon, there were found Tumors of the cecum 11 cases of the ascending colon, 6 of the transverse colon, 12 of the

Mayo, William J. Mortality and End-results in Surgery Surg. Gynec. and Obstet., 1921, xxxii, 97 (February).

descending colon 6 of the sigmoid loop 13 and of the recto-sigmoid, 13 From the beginning to the end of the large bowel there is a wide variation in the symptoms, but individual cases in each group are more or less alike. Thus, there is a gradual transition from the appendix-like complex of the cecum to the almost pure obstruction complex of the sigmoid, but the symptoms of cancer of the cecum and of the sigmoid are in each case quite consistent. It appears also that there is a very considerable range of time in the duration of symptoms before the patients seek relief and in certain parts of the intestine there exists a rather surprising relation between the duration of symptoms and the operability of the growth.

THE CECUM

Let us remember that in this portion of the large intestine the feces are liquid, and perhaps for this reason obstruction is rare. In general, the symptoms resemble those of recurring or subacute appendicitis. Among 11 patients, only 1 suffered from obstruction due directly to the tumor itself. In 3 others the small intestines were obstructed by extensions of the growths outside the cecum, a late result calling attention to an inoperable condition. Whether or not an inflammatory reaction accompanying the growth rather than the direct effect of the tumor itself has been responsible for this tendency it appears that 4 of the 11 patients suffered from attacks of acute or subacute right-sided pain and that another showed typical indigestion suggestive of chronic appendicitis or duodenal ulcer. Five others complained of *attacks* of cramp-like abdominal pain at or below the umbilicus. One suffered merely from indigestion and diarrhea. The average duration of symptoms before the patients sought relief was six to seven months—in the majority about four months and yet only 3 cases were subjected to or were held to be subjects for intestinal resection.

While this is discouraging from an operative standpoint, a résumé of several histories shows that operation might have been performed much earlier had a little more attention been paid to the patient's early complaints, and again, several opera

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beading over. Ten days later he began to feel chilly and feverish, suffered sharp knife-like pains in the right lower quadrant, and became tender to touch in this region. This attack lasted a week. One year later he had similar illness. The attack which brought him to the hospital followed a month after the second. He had then lost 6 pounds during the year. Moderate tenderness was found over the cecum and in the lumbar region, signs noted as being very slight considering the character of the recent symptoms.

At operation a mass suggestive of cancer was found behind the cecum. The appendix was not seen. On the insufficient evidence that no cancer was found on immediate microscopic examination of several adjacent lymph-glands, the wound was drained and nothing further was done. After leaving the hospital he continued during the next year to suffer from local soreness and pain. On his return he was again explored, and was found to have retrocecal cancer accompanying inoperable colloid cancer of the cecum. He died two years later without symptoms of obstruction.

TABLE I

CARCINOMA OF THE CECUM. (11 Cases)

Simulating appendicitis (4)

E. P. (II). Duration, four months. Inoperable.

W. J. W. W. (III). Duration, thirteen months. Disease not found at first operation. Later inoperable.

J. H. (I). Duration, nine months. Operable. Died of recurrence.

P. C. V. Duration, six months. Appendicitis with abscess. No evidence of cancer at first operation. Later inoperable.

Simulating reflex appendix symptoms or aloor (1)

G. P. Duration, eighteen months. Previous appendicectomy had failed to find the tumor. Later inoperable.

Diarrhea and indigestion (1)

A. J. Duration, three months. Inoperable.

Cramp-like abdominal pain (5)

W. E. C. Duration, three months. Operable. Well fourteen months later.

L. G. Duration, five months. Operable(?) Involvement of adjacent small bowel causing obstruction. Operation failed to find lesion. Death from perforation.

C. A. H. Duration, four months. Inoperable.

H. L. F. Duration, four months. Inoperable.

D. H. Duration, two months. Inoperable.

To summarize Cancer of the cecum simulates appendicitis or manifests itself in attacks of abdominal cramps. Intestinal obstruction is rare but may occur late in the disease owing to the growth of the tumor into surrounding regions. The disease is usually advanced when the patient seeks relief. In

tions performed for what was thought to be or what actually was, acute appendicitis failed to discover the carcinoma which was at the bottom of the trouble.

As an illustration of failure to secure an early operation the following history will serve

Case I.—J. H., female, age sixty-three years, Surg. No. 6301. Nine months before entrance the patient experienced an attack of epigastric distress with nausea, followed by severe gripping abdominal pain. During the next week there was localized soreness in the right iliac fossa. She did not go to bed, but saw physician, who told her that she had strained her side, and advised painting with iodine. She suffered similar attack four months later and was then told that she had gall-bladder disease. Following the second attack soreness with exacerbations in the right lower quadrant persisted. Finally she was told that she had appendicitis or tumor and nine months after the initial symptoms entered the hospital. At this time callosity was felt in the appendix region, but on account of the patient's age and persistent cachectic cancer was suspected. At operation the growth was found to have perforated the cecal wall, involving the omentum and the neighboring parietal peritoneum. Even now wide excision was performed, but the patient died eight months later without intestinal symptoms.

The next case offers an illustration of the failure of patient to call a physician attention to a tumor

Case II.—E. P. female, age forty-three years, Surg. No. 1581. Previous history unimportant except for attacks of "inflammation of the bowels" thirty years before, occurring through two years. Four months before entrance the patient began to have severe pain in the right lower quadrant. The pain was cramp-like, nauseating, came at odd times, and was occasionally accompanied by chilly and feverish sensations. Her natural constipation was somewhat increased. She steadily lost strength and ambition, but did not go to bed or call physician until just before entering the hospital. Appendix tumor was diagnosed.

At operation colloid cancer involving the posterior cecal wall and the appendix was found. At second operation soon after the first an ileocecectomy was performed. The patient died six months later.

A third case illustrates one of several instances in which a surgeon failed to find a cancer of the cecum even with the abdomen opened

Case III.—W. J. W. W. male, age sixty-two years, Surg. Nos. 5494 and 7307. The patient first noted a sore spot in the right lower quadrant on

Case IV—T. W. E., male, age thirty years, Surg. No. 8017. For ten and a half years the patient had attacks of dull aching pain in the right iliac fossa, accompanied by local soreness, and occasionally by nausea and vomiting. Movements frequently watery. Blood was noted at times in the movements, and after each discharge the patient felt relieved. Two years before admission the appendix was removed without demonstration of the tumor, but the patient was improved for only a few weeks (presumably through care of the bowels while in hospital). A most significant symptom was feeling of filling up in the right iliac fossa, sensation sometimes relieved by manual pressure. He entered the hospital complaining of pain in the right iliac fossa, nausea, and vomiting. Ray showed filling defect close to the hepatic flexure in the ascending colon. Operation demonstrated cancer at the point indicated in the x-ray with involvement of adjacent lymph-glands, but resection was satisfactorily performed, and two years later when last heard from, the patient was well.

Three other patients suffered from right-sided tumor which in two instances represented the growth itself. In the third the actual cancer caused intermittent distention of the cecum, but was not actually palpable. This case will be described.

Case V—A. E. W. female, age sixty years, Surg. No. 13,306, was ill for three years, steadily losing strength and weight. She suffered from moderate pain in the right iliac fossa, accompanied by local tenderness, and a mass, varying in size, but decreasing with gurgling sound on manipulation, had been felt here for a long time. Attacks of diarrhea increased gradually in severity. Blood was frequently noted in the stools. The patient had been seen by many physicians and the mass thought to be an enlarged kidney. A barium enema demonstrated obstruction in the ascending colon. The patient was much emaciated and ill. On the ground that at this time the cancer was almost certainly incurable, operation, which was not desired by the patient, was not urged.

One may say then, that cancer of the ascending colon gives right-sided symptoms, usually but not always of partial chronic obstruction, that a tumor is frequently present, that the disease is particularly insidious in origin, slow in its course and even when seen late may be both operable and curable.

this series patients presented themselves on an average of six to seven months after the onset of symptoms, 3 only could be considered subjects for radical resection, and 1 only is alive fourteen months after such an operation. The operability would have been considerably increased had attention been paid to recurrent symptoms simulating appendicitis in persons within the familiar cancer age and if operators had searched more carefully for cancer in several patients operated upon under a mistaken diagnosis.

THE ASCENDING COLON

Possibly this portion of the bowel, whose range is somewhat arbitrary should be considered with the cecum, yet here the course of the disease is quite different. I shall consider that the ascending colon begins 2½ inches beyond the tip of the cecum and extends through the hepatic flexure.

Since the feces are again liquid, complete obstruction, as in the cecum, is unusual. One rather complete obstruction only was admitted and operated upon successfully. Of the 6 cases in this series, only 1 imitated appendicitis. As a rule, a tumor of the right side of the abdomen, represented either by the growth itself or by moderate gaseous distention of the cecum was present, a partial obstruction encouraging fermentation and putrefaction behind it. But the most noteworthy characteristic of these tumors has been the remarkably late date at which patients have come to operation and the high operability and curability of the cancer for of the 6 cases with an average duration of symptoms of over two years, 3 were subjected to radical operation, and all 3 are alive two to three years later.

Several cases are worthy of description. The first, which on superficial study simulated appendicitis, should have been regarded as suggestive of cancer.

It is quite probable that tumors in this region interfere with the reversed peristalsis of the ascending colon. In this way the clearing of the liquid bowel contents and the consequent absorption of its fluid is prevented, an encouragement to stasis and putrefaction.

were continually required. Complete obstruction with distention was established several days before entrance to the hospital. Loss of 10 pounds. Distention; visible small intestine peristalsis. A barium enema demonstrated obstruction in the transverse colon near the hepatic flexure.

At operation very much contracted scirrhous cancer was found, and an immediate resection of the cecum, ascending and part of the transverse colon was performed. But though no metastases were noted at operation, cancer soon recurred and overgrew the entire field.

Case VII.—D. J. S., male, age fifty-two years, Surg. N. #267 entered the clinic complaining of pain in the abdomen, with distention. Six months before he experienced an attack of generalized abdominal colic with vomiting. The bowels failed to move until started by cathartics, when diarrhea resulted. One similar attack previous to the most recent. For one week before entrance generalized colic and vomiting. No movements for three days during this period. Strong cathartics were followed as before by diarrhea. Loss of 20 pounds in weight.

Operation was made in two stages, preliminary oostomy followed by resection of an adenocarcinoma of the transverse colon without evidence of metastasis. The result has been complete relief of three years duration continuing to date.

Such symptoms are characteristic of the majority of transverse colon cancers. It is perhaps remarkable that one patient, a girl of twenty-three, came to the hospital within eleven days of the onset of her symptoms which suggested a left-sided lesion and more particularly diverticulitis. Though a barium enema gave notice of a suspicious defect in the region of the splenic flexure exploration was not accepted, and when the patient returned some months later there was found, in fact, an abscess connected with an adenocarcinoma in this region. Resection was followed by fatal recurrence.

Two other cases are exceptional—the first because a palpable tumor was found without symptoms of obstruction (as in several ascending colon tumors) the second because diarrhea was the only complaint.

Five of the 12 cases were subjected to radical operation though judging from the duration of symptoms in some of them—five years, in one instance—it is extraordinary that the tumor should have remained so local. Two of the 5 patients died later of recurrence, and the other 3 are alive respectively one, three and three years after operation. This is not a ver-

TABLE II

THE ASCENDING COLON. (6 CASES.)

Stimulating appendicitis with cecal distention

T. W. E. (IV). Duration, two and half years. Operable. Living, two years.

Tumor of right side emptying on pressure

A. E. W. (V). Duration, three years. Inoperable.

Tumor of right side without abdominal pain or cramps (cancer palpable)

C. L. M. Duration, one year. Operable. Living, two years.

A. B. W. Duration, eight months. Inoperable. Liver metastasis

Anemia right-sided gas-pains, but no obstruction

E. G. M. Duration, five years. Inoperable.

Obstruction

A. R. Duration six months. Operable. Living, three years.

THE TRANSVERSE COLON

In this portion of the bowel there begins to appear a transition between the right-sided symptoms, with or without partial obstruction, characteristic of the cecum and ascending colon, and the truly obstructive symptoms of the bowel beyond. This change represents, perhaps, the effect of solidification of the feces.

Of the 12 patients having cancer of the transverse colon, 7 presented very decided symptoms of obstruction at the time of entrance to the clinic. As a usual thing several attacks resembling the final one but relieved by cathartics preceded it. The attacks were almost invariably characterized by severe abdominal cramps about the umbilicus or lower abdomen, and not on the right, as in cancer of the ascending colon. Vomiting was common, almost invariable, and moderate distention was the rule. While the histories have a definite family resemblance, they vary from a type in which constipation predominates to that in which attacks come rather out of a clear sky. The following cases illustrate respectively the two types.

CASE VI.—D. J. St., male, age fifty-six years, Surg. No. 6748, entered complaining of "pain in abdomen." For one year there had been increasing constipation. Six weeks before entrance sudden abdominal cramps, most severe in the epigastrium, later lower down, no movements for three days with the first attack. Other attacks followed the first, and stronger cathartics

occurred in attacks rather than as an insidious steadily increasing constipation. Indeed one of these 3 complained of no more constipation between attacks than had been present in the past. Of the patients who did not suffer from attacks of obstruction at intervals 2 were increasingly constipated during the course of the disease, and ended by showing the distended abdomen of full obstruction with its familiar concomitant symptoms. But even among the patients suffering from intermittent stoppage there was evidence that the beginning of the large intestine had become increasingly distended and that the pain symptoms arose from difficulty in emptying the small intestine into it. This is consistent with the distribution of the pain, which was almost invariably a general colic, not right-sided, and felt with greatest intensity in the lower abdomen.

The duration of symptoms was, as might be expected long in those patients who suffered from the more intermittent obstruction and short (about six months) in the steadily increasing type. The following histories illustrate respectively the two general varieties.

Case VIII.—H. B. male, age forty years, Surg. No. 4080. Three years before entrance he had experienced sudden stoppage of the bowels, with general abdominal colic, distention, and vomiting. He was under treatment for two months and recovered. From that time and until nine days before admission to the hospital he had had no further trouble. At this time his bowels failed to move and from then on he had eaten nothing, but had not vomited. An enema given on entering the hospital released quantities of gas which soon reaccumulated. An x-ray without barium enema showed ascending, transverse, and upper part of the descending colon to be distended with gas (Fig. 292). Barium enema demonstrated an obstruction in the descending colon.

Operation in three stages, with resection of the descending colon, was followed by recovery. The lymph-glands were not involved. Five years later at the present date, he is well. Undoubtedly the first attack was due to the cancer as illustration of the slow growth of the tumor and its tendency remain local.

Case IX.—F. G. D. male, age fifty-five years, Surg. Nos. 11,153 and 11,373. For six months, constipation accompanied by colicky attacks of general abdominal pain increasing in frequency and severity. Vomiting sometimes accompanied and diarrhea followed the attacks. On entering the hospital barium was given by mouth, but merely showed dilated lower

good showing in view especially of the long time which must elapse before recurrence can be considered as out of the question.

To summarize The majority of transverse colon cancers cause symptoms of obstruction. Abdominal colics are the rule, the pain is usually general, almost never right sided, and the symptoms are apt to appear in attacks. The duration of the disease (at least in this series) is extremely variable, and, *on the whole, it seems hard to believe that in the face of such pronounced symptoms many of these patients can suffer so long before consulting a surgeon.* Great progress is therefore likely to be made through earlier diagnosis.

TABLE III

THE TRANSVERSE COLON. (12 Cases.)

Obstruction symptoms Attacks of cramps (7)

C. McK. Duration, four months. Inoperable.

D. J. S. (VII) Duration, six months. Operable. Living, three years.

J. R. Duration, one year. Inoperable.

S. W. D. Duration, five years. Operable. Living, one year.

D. J. St. (VI) Duration, one year. Operable. Died of recurrence in six months.

J. S. Duration, five months. Inoperable.

D. R. H. Duration, three months. Inoperable.

Epigastric or general abdominal pain (3)

M. E. Duration, six years. Operable. Living, three years.

M. A. P. Duration, six months. Operable. Died of recurrence in fourteen months.

J. C. Duration, five months. Inoperable.

Palpable tumor (1)

C. H. C. Duration, eleven months. Inoperable.

Diarrhea (1)

J. R. Duration, two years. Inoperable.

THE DESCENDING COLON

We are now dealing with that portion of the large intestine in which the feces, having lost their fluid, are temporarily stored or passed on to the sigmoid for evacuation. Obstruction in this region will, therefore, have much the same effect as in the sigmoid. It appears, however from study of the 6 cases in this series that in 3 instances the symptoms of obstruction

THE SIGMOID FLEXURE

The portion of the bowel indicated under this head is the sigmoid loop as far as the rectosigmoid juncture. Here the classic picture of cancerous intestinal obstruction is seen. Of 13 cases, constipation steadily increasing to complete obstipation occurred in 9. Three others suffered from attacks of colic variously situated, but constipation, though evident, was not a prominent symptom. The last had bled from the rectum for some months before intussusception, due to the drag of the tumor brought on by acute obstruction.

The large majority of the patients entered the hospital distended and vomiting yet their symptoms had usually been of rather brief duration. This does not indicate that the tumors are necessarily of rapid growth, but rather that here fecal material may for a long time be forced through a partial obstruction or that an accumulation of feces in the lower large intestine is tolerated for long periods without disturbing symptoms. Indeed, the early disturbances noted by these patients are merely exaggerations of familiar conditions or discomforts. Increasing constipation with occasional gripes or diarrhea (due to putrefaction) does not seem to be alarming to patients or physicians, and it is actually not until complete stoppage has been established for some days that relief is sought.

Such patients as have suffered for even three, four or in one instance in this series eight years from mildly obstructive symptoms demonstrate that when not completely obstructing a cancer may remain local for an extraordinary period. Several of these cases have been re-explored on the supposition that the diagnosis previously made must have been wrong yet here as in many of the patients with a short history the condition has been held to be inoperable.

Judging by the experience of the Mayo Clinic, we have been perhaps misled by local inflammatory reactions into believing the cancer more extensive than it actually was, and yet several otherwise apparently operable cases were found to have liver metastasis while in one instance tissues removed from the point of union of the tumor with the sacrum showed

Brown, and by its delay in the small intestine interfered seriously with the observation of the barium given later by enema. The position of the tumor in the large intestine could not be made out.

Operation in three stages for carcinoma of the descending colon: resection of this portion from splenic flexure to sigmoid. A year and half later the patient remains well.

These two extreme types of history approach each other in the other instances. Both illustrate the backing up of the distention into the small intestine. In both the type of pain is the same. Evidently we must not expect to obtain localizing symptoms in these patients as in tumors of the right side of the colon. One case in the series is the exception which proves the rule. This patient suffered for a year and a half from attacks of high right-sided colic *without* obstruction, the only instance of this kind among the cancers of the transverse and descending colon. It would seem then, that only partial obstruction causes right-sided large intestine colic or looked at another way growths give rise to right-sided pain which cause incomplete obstruction in the beginning of the large intestine where feces are liquid, and rarely in any other portion.

To summarize: Cancer of the descending colon gives rise to symptoms of obstruction. Intermittence of symptoms is still fairly common. Colic is general in distribution. The growths metastasize late and both operability and curability are high.

TABLE IV

THE DESCENDING COLON (6 CASES)

Obstruction in attacks (3)

H. B. (VIII) Duration, three years. Operable. Living, five years

M. L. E. Duration, one year. Operable. Living, three years.

R. E. DeW. Duration, fourteen months. Inoperable.

Obstruction steadily increasing (2)

F. G. D. (IX). Duration, six months. Operable. Living, sixteen months

S. N. P. Duration, seven months. Operable. Died of recurrence at one year

Attacks of colic without constipation or obstruction (1)

H. G. Duration, eighteen months. Inoperable

five days before entrance nose bleed. Vomiting occasionally. An x-ray taken previous to admission showed obstruction in the midsigmoid. On examination, distention of the sigmoid loop and the large intestine above it was obvious. Resection of the sigmoid in two stages gave complete relief, and now one and one-half years later the patient remains well.

Case XII—G. L., male, age fifty-three years, Serg. No. 12,753 always well previous to this illness. Eight months before entrance he noted blood in his bowel movements and lost his appetite. He was treated, without examination, for hemorrhoids, which he did not have. Lost 25 pounds. No constipation. Two weeks before entrance cramps in the lower abdomen were relieved by and followed by diarrhea. A second attack a week later was followed by pelvic distention. There was free blood in the bowel movements. A mass was felt on rectal examination, which at operation proved to be due to an intussusception of the sigmoid caused by the drag of pedunculated adenocarcinoma. Resection in three stages was successful. A year later the patient is well and should remain so.

The second, of course, is an atypical case but points the same moral as the first. Investigation of abnormal intestinal conditions should be made and made early.

TABLE V

THE SIGMOID FLEXURE. (13 CASES)

Steadily increasing constipation ending in obstruction (9)

R. H. A. Duration, five months. Inoperable.

D. T. B. (X) Duration, two and half months. Inoperable.

W. H. C. Duration, one week. Inoperable.

L. A. S. Duration, three weeks. Operable. (Refused after enterostomy.)

W. H. Duration, eight years. Inoperable.

E. C. Duration, four months. Operable. Living, one and half years.

A. Y. Duration, three years. Inoperable. Operation elsewhere. Recurrence.

L. L. R. (XI) Duration, six months. Operable. Living, one and half years.

O. A. B. Duration, four years. Inoperable.

Gripping pain or discomfort (3)

M. L. Duration, eighteen months. Inoperable.

R. S. Duration, twelve months. Inoperable.

M. T. McC. Duration, three months. Inoperable.

Bleeding, deterioration, followed by attacks of obstruction (1)

G. L. (XII) Duration, eight months. Operable. Living, one year.

To summarize. Of 13 cases of cancer in the sigmoid loop the large majority present the classic picture of constipation ending in obstruction. The evidence is to the effect that the

cancer spreading through the peritoneum. However we may have misread the indications for extirpation, the fact remains that cancer of the sigmoid usually shows itself convincingly at a late and often hopeless stage and this in spite of the fact that it is habitually slow in growth. Of the 13 cases in this series, only 4 were considered suitable for resection, though all but one were explored. These 4 had had symptoms for three, four six and eight months respectively and yet others whose symptoms dated back one week, three weeks, ten weeks, and five months were held on exploration to be hopeless.

I may perhaps illustrate what I have just said by one or two histories. The first represents the type in which the disease is found far advanced after only a few weeks of trouble.

Case X.—D. T. B., male, age seventy-one years, Sory. No. 7317. Ten weeks before entrance the patient began to feel tired and to lose his appetite. One week later he became constipated. Cathartics were effectual. He was told that he had "walking typhoid." On special diet his bowels began to move better. He passed many small hard movements daily. Occasional vague colic. In the hospital, because of low septic temperature and tender mass in the pelvis, he was thought to have tuberculous peritonitis, diverticulitis, or cancer. H. was much emaciated. Exploration showed obstruction in the sigmoid and matting together of the small intestines about the growth. Gray nodules of cancer on the surface of the adjacent bowel were found. He was held to be incurable and sigmoidostomy was made. He died in the hospital two months later. About improvement or opportunity for further surgery.

Here the growth was far advanced and the patient began to deteriorate *before* any characteristic symptoms were evident. Indeed, it seems to be a matter of luck that certain persons suffering from cancer of the sigmoid develop obstruction at an early and clearly operative stage. Though the result in the 2 following cases is likely to be excellent, neither patient nor physician can be complimented upon the successful outcome.

Case XI.—L. L. R., female, age forty-six years, Sory. No. 11,837. The patient's bowels had always been regular up to the onset of her illness. Six months previously she had begun to notice constipation. This steadily increased in degree, but up to ten days before entrance had been relieved by cathartics. From that time on there had been grating creak in the lower abdomen and peristalsis visible in the patient. A small bowel movement

who noted no blood would have demonstrated it microscopically or chemically long before entrance to the hospital. It is hardly necessary to point out that all patients to whom blood was evident in the movements should have received at an early date the rectal examination which usually discloses the tumor and should not have been treated on insufficient evidence, as is usually the case as if suffering from hemorrhoids. Moreover the 2 patients who experienced attacks of intermittent obstruction and whose stories date back a year each, either neglected their health or were slighted by their physicians.

There is, then obviously room for improvement in the diagnosis of cancer in this vicinity and this not because of the urgency of the symptoms, but rather because the presence of blood in the stools offers a clear indication for rectal examination, digital and proctoscopic, and for the use of the barium enema. The latter is quite likely to indicate obstruction even if the former discloses nothing since as the histories clearly show most patients have definite obstruction symptoms.

Here I should like to say a word as to the use of the x-ray in diagnosing cancer of the large bowel. In this series it has been exceedingly effective if the enema is used and rather ineffective if barium is given by mouth. In one instance a barium enema failed to demonstrate a lateral cancer of the cecum (Fig 286) and in another a clean bill of health was given a young woman whose symptoms strongly suggested a diverticulitis or cancer of the transverse colon. In the latter instance one examination suggested a defect in the bowel wall and a second failed to demonstrate it. It is undoubtedly the surgeon's (the writer's) fault that this discrepancy in observing early cancer was not allowed for. In several cases the roentgenologist reported that the patient could not retain the barium but observed no definite obstruction. Here the failure to retain the barium was nearly as important as if a clean-cut defect had been seen.

As to barium by mouth the story is quite different. In the first place barium should not, of course be given by mouth to patients suspected of obstruction, since it loads up the bowel,

tumors are of slow growth, bringing patients to the surgeon at a late stage in their course, though often fairly soon after symptoms have become evident. Progress is more likely to be made by increased boldness in operating than by securing earlier opportunity to operate, for the symptoms are not such as to lead to much hope of early surgery and inflammatory reactions about the tumor imitating extension of the cancer doubtless allow (as demonstrated by Dr W J Mayo¹) more radical and successful operations than have generally been performed.

THE RECTOSIGMOID JUNCTURE

These growths ought perhaps to be regarded as cancers of the rectum or in some instances, of the sigmoid proper. As a class they naturally resemble cancers of the sigmoid, but they introduce a symptom rare in tumors higher up, observable by the patient and therefore important—the gross bleeding. They appear to be the most hopeless, from the point of view of operability of any in the series. In this series of 13 patients, 1 only was definitely operable, while 2 others might well have been, but died after a preliminary colostomy. As the one operable case died as a result of resection, one can hardly imagine a worse showing. Curiously enough, no class of cancers comes so early if one may judge by the symptoms, to operation. Only 4 patients had had knowledge of symptoms dating back more than six months and 5 had suffered for two months or less. The tumors must then have a long latent period or they must be very rapidly growing. Judging by what we know of cancer of the large intestine in general the former is perhaps more likely.

As to symptoms, constipation leading on to obstruction was present in 9 among whom 5 had had noticeable blood in the stools. Two others had had attacks of cramps ending in obstruction, but not accompanied by constipation between attacks, and two had suffered from diarrhea accompanied by bleeding. Evidently bleeding is a common and important symptom, and doubtless examination of the stools of those

SUMMARY

One hardly would dare to draw very strong conclusions from a study of this small series of cases, particularly as to the operability operative mortality or curability of cancer of the large bowel. Indeed, the operative indications and results are not at issue here except in so far as they relate to the nature and duration of symptoms. These symptoms possess in any one part of the bowel, family resemblance with minor variations as between distant parts, gross differences shading into each other in the intermediate portions. The right side of the intestine, into which the liquid contents of the small intestine are emptied responds in one way the left side, containing dried and drying fecal matter in another. This difference is perhaps intensified by the failure of tumors of the cecum and ascending colon to cause the scirrhous constrictions so often seen farther along. It is also quite possible that tumors of the right side of the colon interrupt the reversed peristalsis which occurs here. For the reversed peristalsis which begins in the proximal part of the transverse colon, passes back over the ascending colon and cecum, churning the liquid feces, and by forcing them into the interstices of the mucous membrane, is an important agent in removing their fluid. Interruption of this peristalsis by a tumor may conceivably then, increase stagnation and fermentation. On the other hand, tumors in the transverse colon and beyond, though obstructing do not necessarily interfere with the motility of the right side of the large intestine, which may gradually hypertrophy and distend without causing any symptoms until the distention is passed back to the lower small intestine.

Tumors of the cecum cause intermittent rather than steadily progressive symptoms which may simulate recurrent appendicitis or may show themselves as low abdominal colics. The symptoms, on the whole, come late in the development of the tumor. Patients seek relief earlier than in cancer of most other parts of the large intestine, but the operability is low. Since appendicitis is imitated and apparently in some instances initiated by the tumor much is to be expected by earlier and

and even if it passes through is likely to leave the lower small intestine filled for a considerable period, obscuring the view in examination by enema (Figs. 284-287). In any case, therefore, enema should be given first. And again, it is the fluoroscopic examination as the barium flows in, which most clearly demonstrates cancer in the large intestine, since a narrow tumor causing little obstruction may well fail to show in a plate. But there is one form of examination which is exceedingly valuable, simple and requiring no injection whatever. This is the plate of the abdomen to show gas accumulation in the bowel. Excellent localizations have been made in persons with partial obstruction by showing gas-filled bowels above the tumor and while no positive diagnosis can be made in this way such evidence, especially in weak distended patients, is most helpful (Fig. 292). The x-ray may be said to be most important and, in expert hands, extremely accurate in diagnosing cancer of the large intestine. A positive diagnosis must, however, be regarded as more important than a negative examination.

TABLE VI

THE RECORDS. (13 CASES)

Constipation increasing to obstruction (4)

E. C. K. Duration, six months. Inoperable (?). Died after preliminary operation. Second had been contemplated.

M. E. R. Duration, one and half months. Inoperable (?).

F. W. A. R. T. Duration, two months. Operable. Died following operation.

G. T. G. Duration, one month. Inoperable.

Constipation increasing to obstruction, with blood in stool (5)

P. W. M. Duration, six months. Inoperable.

G. T. W. Duration, three months. Inoperable.

J. T. H. Duration, two years. Inoperable.

A. B. Duration, two months. Inoperable.

G. T. Duration, three years. Inoperable. Small tumor. Nodules in liver.

Abdominal cramps in attacks ending in obstruction (2)

H. M. G. Duration, eleven months. Inoperable.

A. E. D. Duration, twelve months. Inoperable.

Diarrhea with blood in stools (2)

T. M. Duration, two years. Inoperable.

J. M. W. Duration, six months. Inoperable.

physical examinations, and by ceasing to wait for physical incapacitation before urging surgical relief could have helped still more. And when all is said and done, if we are to *cure* internal cancer we must act on suspicion and without full proof. We may at times explore an innocent abdomen, but we shall save more lives.



Fig. 234.—W. E. C. Cancer of cecum. Barium by mouth. Note dilated coils of ileum filled with barium mixture and gas. Arrow indicates region of tumor. Compare with Fig. 235.

more careful operating for recurrent or persistent symptoms of appendicitis in persons within the cancer age. Obstruction is not a symptom to be looked for.

Cancers of the ascending colon rarely cause the familiar obstructive symptoms. Right-sided tumor may develop without any obstruction or through visible filling of the cecum. Soreness, pain, or colic is right-sided. Development is slow and operability is high.

In the transverse colon obstruction is the rule, but progressive constipation is seldom seen. Intermittent attacks of general abdominal colic accompanied by constipation are the usual manifestations. A palpable tumor or even diarrhea may be the only complaint. The duration of symptoms is extraordinarily irregular and the growths metastasize late giving a fairly high operability.

In the descending colon cancer manifests itself about as often by slowly increasing constipation as by intermittent obstructive attacks. The development of the growths is slow and operability is astonishingly high.

In the sigmoid is seen the classic picture of large intestine cancer. Gradual onset of obstruction through months or years of constipation is the rule. The symptoms calling for relief may often be of comparatively short duration, but tend to show themselves late in the development of the disease. The operability is low but may well be raised by bolder operating.

Cancer in the rectosigmoid region resembles that in the sigmoid, with this important additional sign—gross bleeding. Symptoms are of short duration, and the disease is advanced before they have been long urgent, but improvement in treatment is to be expected both through earlier diagnosis and by more bold and skilful operating.

I have tried to point out the common rather than exceptional manifestations of cancer of the large bowel, to explain the variations, and to suggest how they may lead to better surgical treatment. By correcting obvious errors in our treatment of this series much might have been accomplished. The general practitioner by taking better histories, by more thorough



Fig. 287.—T. W. E. (Case IV.) Cancer of ascending colon. Barium by mouth. Note filling defect in bar appears to be the cecum, and dilatation and accumulation of material in lower ileum. Compare with Fig. 288.

Fig. 288.—T. W. F. (Case IV.) Cancer of ascending colon. Barium enema. Note filling defect in ascending colon and small amount of barium in cecum below. Compare with Fig. 287.



Fig. 234.—L. G. Cancer of rectum. Barium enema. Arrow points small lateral defect in rectal wall. This was related on the histological examination.



Fig. 233.—W. K. C. Cancer of rectum. Barium enema. Note filling defect in rectum. The ascending colon has anastomosis and hangs below the rectum. Compare with Fig. 234 (the same patient).



Fig. 291.—(C. N. K.) Cancer of transverse colon. Barium enema. No gross dilatation of cecum and transverse colon. The region of the growth is indicated by the meeting of the dilated transverse colon with the contracted barium-filled bowel beyond.



Fig. 292.—(H. B.) (Case VIII.) Cancer of descending colon. Plate of distended abdomen without introduction of barium enema. The outlines of the transverse colon are emphasized by dotted lines. The tumor is at the distal end of the dilated descending colon indicated by arrow.



Fig. 260.—D. W. 46. (Case VI.) Cluster of translucent colonies. *Ilaridium eorum*. Not definite oval outline noted as shown by normal. Compare with Fig. 259.



Fig. 259.—D. W. 44. (Case VI.) Cluster of translucent colonies. *Ilaridium eorum*. Not known of observation in translucent colonies. The dense middle of Compare with Fig. 260.

CONTRIBUTION BY DR. WYMAN WHITTEMORE

MASSACHUSETTS GENERAL HOSPITAL

LUNG ABSCESS

DURING the last few years at the Massachusetts General Hospital we have made an effort to differentiate between lung abscess and bronchiectasis before operation. In order to do this very close co-operation has been demanded and obtained between the medical man, surgeon, x ray department and laboratory. I believe the results of this work justify the statement that in the great majority of cases this differential diagnosis can be made previous to operation and this is said in spite of the opinion which is occasionally expressed in literature that lung abscess, bronchiectasis, and gangrene are all one and the same process, merely differing in the extent and progress of the lesion.

It is essential that the surgeon be able to make his own diagnosis after weighing all the facts of the case. Although at the Massachusetts General Hospital and probably in all large general hospitals the majority of lung abscess cases are admitted on the medical service, where they are carefully worked up yet the surgeon must be able to confirm or disagree with the diagnosis as the ultimate responsibility for the life or death of the patient will be largely his. And as time goes on we find that more and more of these cases are admitted directly to the surgical service, where it is my belief they all belong.

Etiology—The most common factor in our series of lung abscesses at the Massachusetts General Hospital has been the precedence of an operation on the upper respiratory tract under a general anesthetic. Out of 32 cases in which the etiology was definite 17 were due to the removal of tonsils, 1 to the removal of adenoid only and 3 to the extraction of teeth this

woman entered the Massachusetts General Hospital with puerperal sepsis, and within forty-eight hours had symptoms of an infarct in the right upper lobe. An abscess of this lobe developed, and was operated on. She died six weeks after operation and autopsy showed the lung abscess healed but the left ovarian vein was a large abscess.

There are occasional cases caused by extension of or perforation from, a septic process outside the lung for example from subdiaphragmatic abscess and suppuration in the mediastinum. Case 36 in this series, had a lung abscess that was caused by a septic process in the mediastinum breaking through into a bronchus, and at the same time or soon after it also broke through into the esophagus, so that after the lung abscess was drained we found we were dealing with a broncho-esophageal fistula. Fortunately this case entirely recovered.

Extension of infection or rupture from the pleural cavity into the lung undoubtedly gives rise to a breaking down of lung tissue and abscess formation in a small number of cases. Case 38 originally had an empyema that was drained, but recurred and was neglected. He developed typical symptoms of lung abscess, with many very severe hemorrhages. The abscess was drained and he recovered completely. The diagnosis of empyema plus lung abscess, previous to operation is difficult, and should not be confused with the rather common case of neglected empyema that perforates into a bronchus. Not infrequently cases are sent into the hospital diagnosed as lung abscess which prove to be empyemas that clear up rapidly when the pleural cavity is drained and show no evidence of lung abscess.

Actinomycosis is an extremely rare cause and during the last eight years we have had only 2 such cases at the Massachusetts General Hospital.

Age seems to have little bearing on the etiology except for the fact that in children under ten years of age abscess of the lung seldom occurs, and even up to twenty is rare. From twenty to forty is the most common period but cases have occurred up to sixty three years.

giving a total of 21 cases, or 65 per cent., due to this cause. I wish to lay great stress on this, and again bring to the attention of the general practitioner who does such operations, as well as of the specialist, the fact that there is a real danger of lung abscess, and what starts out to be a simple operation, at least in the layman's mind, ends as a most serious surgical condition, and in a certain number of cases as a terrible tragedy. Recently a strong healthy man of thirty nine was examined and passed for life insurance, but was advised to have his tonsils removed. He consented to this and they were removed under ether within a week he had an infection of the right lung and an abscess close to the hilum was soon demonstrated. I drained the abscess, and he did well for two weeks, and then gradually got worse and died of septicemia five weeks after operation. Surely here what started out as a simple "safe" operation turned into a tragic catastrophe. A short time ago there were 5 lung abscess cases on the surgical service all of which had been preceded by the removal of tonsils under a general anesthetic. Of course the percentage of cases that develop abscesses following these operations is extremely small but the specialists and those general practitioners who do these operations should realize that there is this danger and they are the ones to do "preventive medicine" by seeing that their patients are so operated on that this condition does not occur. Lord says, "In 25 of 100 cases, or 1 out of every 4 the cause may be definitely traced to operation about the upper respiratory tract. Pulmonary abscess followed operation about the mouth for cancer of jaw lip and tongue in 1 case each, the removal of tonsils or tonsils and adenoids in 12 cases, the incision of peritonsillar abscess in 1 and the removal of teeth in 9.

The next most common cause of lung abscess is bronchopneumonia occasionally lobar pneumonia but this is seldom the cause, contrary to the statements made in medical text-books. Septic infarct will be the cause in a certain small number of cases, this occurring in connection with pyemia where septic thrombus is set free in the venous circulation, for example, in septic puerperal thrombosis. Several years ago a young married

months or even a year previous to entrance. Onset in lung abscess is an acute condition following within three or four days, to a week or ten days after a tonsillectomy for example, starting with sudden pain in the chest, fever and cough and after a few days a sudden expectoration of a considerable amount of foul-tasting and smelling pus. On the other hand, a bronchiectasis is a gradual chronic condition cough and fever to be sure but a gradual slow increase of expectoration. E O Otis says in differentiating abscess from tuberculosis, that in the former there is a fetid sputum which never occurs in tuberculosis, and there is generally some discoverable primary cause such as a previous operation or sepsis somewhere or an embolism. The spitting of blood is found in lung abscess, bronchiectasis, tuberculosis, and malignant disease, and so that in itself has no differential value in distinguishing between these conditions. Many abscess cases can rest comfortably lying on their backs or on the diseased side, but sudden turning on to their well side causes a paroxysm of coughing and the raising of a large amount of sputum. Primary malignant disease of the lung does not seem to be so rare as formerly supposed. It is possible to have cough, fever and a blood tinged purv expectoration with cancer and without a careful history including age as primary malignant disease of the lung only rarely appears before the 40's cancer may easily be confused with abscess. A leukocytosis if present, may be of value, but if absent is of no significance. Bronchiectasis, although no age is exempt, is rare in children. The onset is an insidious one, the patient in many cases knowing of no definite beginning. In others there may have been a slight infection of the respiratory tract, with cough and persistent sputum. The cough is worse during the winter months.

2 *Sputum Examination*—In medical books too little emphasis has been laid on the great importance of the examination of the sputum. This is such an important examination and so much knowledge may be gained from the study of the sputum that no case is accepted for operation until the sputum has been examined not once, but several times, by the best expert that I

Situation—It is the general belief that the majority of abscesses are situated in the lower lobe, and this would seem reasonable to suppose, especially in those cases due to aspiration, but this has been contrary to the findings in my series of cases. In 22 cases the abscess was in the upper lobe, and in 19 it was in the lower lobe. Louis Hamman says, Aspiration abscesses, particularly postoperative, are more frequent in the upper lobe than the lower about 2 to 1. Postpneumonic abscesses occur more frequently in the lower lobe than in the upper about 2 to 1. It is an important fact that most abscesses are situated in the periphery of the lung. Of 30 cases coming to autopsy at the Massachusetts General Hospital, the lesions were in the periphery in 28. Another important fact from a surgical point of view is that in the majority of cases the visceral and parietal pleurae are adherent near the site of the lesion. They may be firmly adherent or merely held by delicate adhesions. In 35 cases coming to autopsy at the Massachusetts General Hospital, the visceral and parietal pleurae were adherent in one form or another in 30. This is very important from the operative point of view as it would seem and indeed it is true that in the majority of cases it will not be necessary to use any differential pressure anesthesia. But as there is no reliable means of knowing before operation whether or not the lung is free or adherent, it would seem wise to use or at least have at hand some form of positive pressure anesthesia when doing this operation.

Diagnosis.—The most common conditions that must be differentiated from lung abscess are localized bronchiectasis, encapsulated empyema, tuberculosis, and malignant disease that has broken down. It is my belief that this diagnosis can be made in most of the cases. This is based on four vitally important examinations: 1 History 2 Sputum 3 x Ray 4 Physical.

1 *History*.—Too much stress cannot be laid on careful, painstaking history as the onset plays a very important part in making the correct diagnosis. Often the history is difficult to obtain, especially in hospital patients of foreign extraction, and particularly when the disease dates back three or four

had been given to the search Streptococci pneumococci, staphylococci and influenza bacilli are generally found and also appear in cases of bronchiectasis, but in cases of bronchiectasis the influenza bacillus both intracellular and extracellular is the predominating organism whereas in abscess it is never the predominating organism. A most important observation has been made by W. H. Smith (which has not been published but which he has been kind enough to allow me to mention). He states that he has never found hematoidin crystals present in the



Fig. 294.—Sputum. Case of bronchiectasis. 1. Influenza bacilli intracellular.

sputum except when pus has been found at operation, and the pus has always been a streptococcus pus. When only one kind of organism is found in the sputum (for example pneumococci or streptococci) this points toward an empyema rather than an abscess, as in the latter there is always a mixture of organisms.

3. *x Ray Examination*—This is the most important examination, as it not only confirms or indeed makes the diagnosis but also localizes very definitely the process, which is of the greatest value to the surgeon. Holmes and Ruggles say abscesses assume the form of irregular areas of increased density which are most

can find. Tuberculosis must be excluded this requiring many examinations, and then a differential diagnosis made, so far as possible, between lung abscess and bronchiectasis. In abscess the sputum is purulent or mucopurulent, yellow green or brownish in color varying in amount from 2 to 20 or even 30 ounces in twenty four hours. Although it may be odorless, yet in most cases it has a fetor that is very definite, but not as offensive as that found in gangrene or advanced bronchiectasis.



Fig. 293.—Sputum. Case of bronchiectasis. Inflamed bacilli and pneumococci.

Pus from a single cavity tends to be homogeneous, with little mucus, whereas that from many small cavities is apt to be made up of small masses with considerable mucus; however too much stress must not be placed on this. On standing the sputum separates into three layers: mucus on top, saliva in the middle, and pus at the bottom. If elastic fibers are found, their presence points very strongly toward abscess. In my cases these have not been found in more than 4 cases out of each 10, but it may be that they would have been found more frequently if more time

ribs below where operation proved it to be. I believe this error may be due to the fact that x ray plates are taken with the lung in the position that it assumes in full inspiration. At operation the lung is not in this position, and we have found that



Fig. 296.—Very large lung abscess cavity showing fluid level.

we were one or two ribs too low. Unquestionably the most favorable cases for operation are those in which the x-ray shows the lesion to be situated near the periphery of the lung and in which a fluid level can be demonstrated. I hesitate to advise

marked at the center fading out toward the periphery when filled with fluid they are indistinguishable from the general shadow about them, but the large ones become very evident when filled with air particularly if they contain sufficient fluid to cause a fluid level. They are seen as round areas of greatly diminished density and, if a fluid level is present, its surface shifts according to the position of the patient. The localization is often disappointing to the surgeon because of the zone of pneumonic infiltration about them which magnifies the area of



Fig 295—Sputum Case of lung abscess. Elastic fibers.

involvement. Bronchopneumonia may be differentiated by the fact that it gives a shadow of more uniform density and there is no cavity formation. In bronchiectasis there is an extensive thickening of lung markings along the course of the large bronchi and enlargement of the hilus glands, with the presence of single or multiple areas of increased density in the lung fields near the bronchi—cavities are often to be demonstrated. In a number of my cases in which the lung and pleura were not adherent the x-ray has localized the process one or even two

and tactile fremitus may be present on the other hand increased voice, whisper and tactile fremitus may be present when the cavity communicates directly with a bronchus. The typical classical signs of cavity—tympany on percussion, amphoric breathing and cracked-pot resonance—are seldom found



Fig. 296—Lateral x-ray of lung abscess. Sometimes this view is of great value in localizing the process.

No hard-and-fast rules can be laid down for or against operation. Each case must be decided on its own merits. In cases in which the sputum is not foul, small in amount, not over 1 or 2 ounces in twenty-four hours, only slight or even absent signs of sepsis present. It is well to delay operation, making care

operation in those cases in which the x ray in spite of plates taken before and after the patient has attempted to empty the cavity fails to show a fluid level, especially if situated near the periphery of the lung. On the other hand it has been my experience that often x ray fails to demonstrate a fluid level in those cases in which the abscess is situated near the hilum.

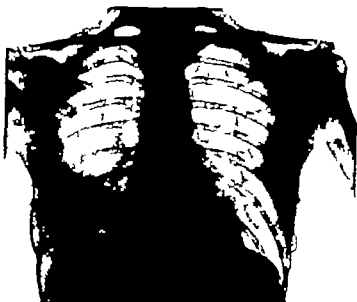


Fig. 297.—Lung abscess at level of eighth rib. At operation abscess between seventh and eighth ribs.

4 *Physical Examination* This examination is disappointing in many cases. In those cases in which the abscess is very deeply situated about the lung root there may be no signs suggestive of an abscess, and even in cavities in the periphery of the lung the signs may be very slight. However in most cases there is some change from normal that can be demonstrated, slight though it may be. The most common sign found is dullness on percussion. Other signs are variable: diminished voice, whisper

one may feel sure that the lung is adherent and that the abscess is not far distant. Occasionally although to inspection the pleura may appear normal, yet by palpation a firm hard sense of resistance is felt, and again one may be sure that the region of the abscess is found. If on the other hand the pleura is normal and the lung seen moving under it, the chances are that the abscess is not in this region. More ribs should be removed and further inspection and palpation done. As the majority of abscesses are in the periphery of the lung and in most instances the lung is adherent to the costal pleura in the region nearest to the lesion, this place must be found. In cases in which the abscess is deeply situated and the lung not adherent, the pleural cavity should be opened under positive pressure and the lobe of the lung palpated. After localizing the region of the abscess this region should be sutured to the costal pleura. It is safe to wait two or three days for adhesions to form before opening the abscess, as if it is opened at this time there may be a leakage of pus through the suture, with an empyema resulting. But in cases in which it seems unwise to wait, the abscess may be opened using gauze for walling off in addition to the suture. Cases 30 and 32 were operated upon in this way. Case 32 developing a small empyema, which was easily taken care of. Case 30 did not develop empyema. The technic of opening the abscess will vary according to the operator. I see nothing to be gained by aspiration, except to give the surgeon some moral support, as if one does not find the abscess with the needle, it does not at all imply that there is no abscess present. I have always made an incision into the lung and then opened into the abscess with my finger. In most cases, having opened the abscess, pus will be seen. However in a few no pus is seen but the operator is greeted with a blast of very foul-smelling air. These are the two proofs that the abscess has been opened. In the cases in which foul-smelling air but no pus is demonstrated if drainage is established from this area pus will be coming out within forty eight hours. It may be a good technic to pack the cavity with gauze for several days to control any bleeding that may take place but patients do not like it as until good drainage is

or let the resistance of the patient be lowered, and there will be a rapid recurrence of symptoms.

Cases 23 and 30 are good illustrations. Case 23 was a man in the 40's, with an abscess in the right upper lobe. Following operation his cough and expectoration stopped, but he was drained intentionally until there was a small fistula, from which in twenty four hours there were only 2 or 3 drops of pus. At the end of five months he was in fine condition and back at work. He then stayed drunk for a week with the result that all his symptoms returned. Case 30 was a girl of fourteen years with an abscess in the right lower lobe, which was drained and her cough and expectoration ceased. Three months later in spite of careful directions given to her and her family her doctor insisted on removing the drainage-tube. The sinus rapidly closed and again all her symptoms returned.

Operation.—Anesthesia plays a very important part in the immediate operative results. Local anesthesia is the one of choice, and can be used in all cases in which the lung is adherent to the costal pleura, but cannot be used in those in which the lung is not adherent unless a two-stage operation is done. Fortunately we know that in the majority of cases the lung is adherent, but unfortunately we have no means of determining before operation whether or not this condition exists. In the cases that are not adherent some form of positive pressure anesthesia must be used if the abscess is to be found and drained in one sitting.

Although there can be no question but what the two-stage operation is the safest, yet in using this procedure in a number of cases the abscesses have not been found and so this technic has been abandoned. The only sure way of localizing the abscess is by palpation and inspection. The surgeon who is going to do thoracic surgery should spend as many hours as possible at the autopsy table educating his sense of touch to familiarize himself with lung conditions. There is one golden time to find the abscess, and that is at the first operation. After opening a window down to the pleura, this should be inspected and palpated. If the pleura is thickened and grayish in color

tube was not changed and on the sixteenth day following operation there was a severe hemorrhage, but fortunately not a fatal one. Postoperative hemorrhage is a very real danger in spite of frequently changing the position of the drainage-tube. Not infrequently we have had a hemorrhage some time between the third and tenth day after operation. This we have been able to control so far in all cases. At times it has been necessary to open the wound and pack the cavity but the trauma caused by this procedure tends to spread the infection.

This series of 45 cases are those that I have seen during the last four years, and I believe the diagnosis of lung abscess was correctly made in each case 40 were at the Massachusetts General Hospital and the remaining 5 outside the hospital. Out of 31 cases that I operated upon, 5 died following operation, a mortality of 16 per cent. 5 spontaneously recovered 4 were operated upon by other surgeons outside the hospital. Of these, 1 entered the hospital two years later and died following an operation for empyema. A second case died eight days after operation with symptoms of "meningitis." The other 2 I cannot trace. Of my own cases 2 patients refused operation and left the hospital, and 3 died without operation. 1 of these, Case 7 refused operation, and died from a brain abscess the second, Case 43 was a man sixty three years old and died of streptococcus septicemia a few days after entrance, and at autopsy the middle lobe was a large gangrenous cavity. The third case, No. 45 was desperately sick on entrance and died before the lesion could be localized. This death was very sudden and probably was due to a cerebral complication.

It is interesting to analyze the 5 deaths following operation in this series of mine to see if any information can be gained so that better results may be obtained in the future. Case 19 was a strong young man who developed pneumonia following a gastric operation. Abscess of the lung developed and he was operated upon under gas-oxygen anesthesia. Lobar pneumonia on the other side appeared within three days and he died three days later. Autopsy showed this and that the abscess had been correctly drained. There seems to be little question but what if

established they still cough up large amounts of pus. Probably the best technic is to place a soft-rubber tube into the cavity and pack gauze around it.

It is necessary to drain the chronic cases indefinitely and the acute cases at least three or four weeks. The position of the



Fig. 299.—Gangrenous necrotic cavity involving greater part of upper lobe

drainage-tube must be changed at least every forty-eight hours, and it is better to change it every twenty four hours. This is done to prevent hemorrhage caused by the end of the tube ulcerating through the wall of any blood-vessel that it may rest on. In one case that I had six years ago the position of the

some pus 2 cases recurred as the drainage-tubes were taken out too soon and contrary to our orders both cases were drained again at secondary operations. One case died from puerperal sepsis, 1 case from brain abscess six months after operation. In 3 cases tubercle bacilli were found in the sputum three to four months after leaving the hospital and the remaining 4 have not been traced. Were the 3 cases in which tubercle bacilli were found some time after operation tubercular abscess at the time of operation? Two of these were upper lobe abscesses and 1 was in the lower lobe. We are naturally more suspicious of upper lobe lesions being tubercular than lower lobe ones. The greatest possible care has been taken in all cases preceding operation, to eliminate the danger of operation on tubercular abscesses and the sputum is examined many times. Tubercle bacilli were not found in any of these 3 cases during repeated examinations before operation. It seems possible that the severe trauma caused by operation and prolonged drainage may light up a latent tubercular condition or make the lung more susceptible to tubercular invasion.

Although 12 cases are considered well, and another 5 are improved, and may eventually become well, yet in these results only 60 to 70 per cent. of the cases successfully operated upon are permanently cured or improved.

SUMMARY

- 1 Many cases of lung abscess could be avoided by a more careful technic in removing tonsils, adenoids and teeth.
2. It seems possible to make a differential diagnosis between lung abscess and bronchiectasis in a majority of the cases.
- 3 Lung abscess cases that do not definitely improve in three to four weeks should be operated on. Operation should be done before the case becomes chronic, as the chances of permanent cure are much greater in the acute stage than in the chronic stage.
- 4 There will always be some mortality varying with the kind of case.
- 5 Early diagnosis and early operation will produce the best results.

the operation had been done under local anesthesia the pneumonia might not have developed. Case 22 was a man in the late 50's. At operation there was a large amount of foul, thin pus and large masses of necrotic lung tissue were floating in the cavity. Some of these were removed at the time and others drained out after operation. This was probably a gangrenous condition, and he did not enter the hospital early enough while the process was a comparatively small abscess, but waited until the destructive process had gone on too far. In this case with earlier operation the outcome might have been different. Case 27 was a strong fat woman in the early 30's. Three days after operation she had a severe hemorrhage, although the cavity was drained with a soft tube and gauze packing. It was necessary to open the wound and pack the cavity. She developed cerebral symptoms suddenly three weeks after operation when we thought her well on the road to recovery. She died and, unfortunately there was no autopsy but she probably died from a brain abscess. It is a question whether or not the packing of the cavity to control the hemorrhage had any bearing on this. Cases 28 and 31 were deeply situated abscesses that drained very satisfactorily following operation but both ran high septic temperatures and died with septic symptoms three to four weeks later.

In summing up these 5 deaths it seems probable that the first was due to poor judgment in using a general anesthetic that the second should have been operated upon earlier that in the third case if the cavity had been packed more tightly at operation a secondary hemorrhage might have been avoided and so the fatality might not have occurred although this cannot be certain, as the patient did not die from hemorrhage. But in the last 2 cases I fail to find any evidence of bad judgment or technic which could be improved with the hope of avoiding future failures.

It has been difficult to trace the final results of the 26 cases of my own that recovered from the operation. 12 have remained well over periods varying from five months to two years. 3 cases are still discharging a little pus from their sinuses. 2 of these are free from cough, but the other is still coughing and raising

CLINIC OF DR. LINCOLN DAVIS

MASSACHUSETTS GENERAL HOSPITAL

THE SURGICAL TREATMENT OF CARCINOMA OF THE CERVIX UTERI

At the present time there is a marked tendency in many clinics toward the abandonment of the radical operation for cancer of the cervix in favor of radium treatment. In these same clinics radical operations are being prosecuted with great vigor in cases of cancer of the lip tongue breast stomach, colon and rectum. What is the reason for this?

It can be said at once that radium has so far not proved itself of great value in cancer of deep-seated organs, such as the stomach and intestine so that in those regions reliance must still be placed on surgery. As regards cancer of directly accessible organs, such as the lip tongue, mouth, and cervix, the general attitude of cancer experts has been well expressed by Dr. R. B. Greenough at a recent meeting of the New England Surgical Society. He stated that radical operations for the cure of cancer are based on the fact that removal of the regional lymph-nodes as well as the local focus of disease, has been proved to result in a larger number of cures than when the latter was merely removed the radical operation permitting of cure when the disease has extended beyond its point of origin. He continues as follows: "For this reason the treatment of cancer of the lip by radium must be regarded as a step backward to the time of the early and incomplete operations for the cure of this disease. In fact, the radium treatment of operable cases of cancer of the lip is not countenanced in the best clinics.

When we come to cancer of the cervix, conditions are not quite the same. The Wertheim operation is intended to accom

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Wide removal of parametrial tissue, as well as a liberal cuff of vaginal wall however are essential features of the radical operation, and are as rational, it seems to me, as is the removal of a wide margin of skin and the pectoral muscles in a complete operation for cancer of the breast.



FIG. 100.—Case 1. Posterior view of uterus, arrow points to invaded parametrium.

That the radical operation is capable of curing, for at least a number of years cases in which the disease has extended beyond the point of origin is attested by the following 2 cases.

Case L—P. P. Hospital No. E. S. 209,616. An Italian woman, forty-seven years old, the mother of 11 children, entered the Massachusetts General Hospital on July 24, 1916. On examination the cervix was found to be replaced by a hard

plish in cancer of the uterus what the complete operation does in cancer of the lip or cancer of the breast. There is little evidence, however, that cases of cancer of the cervix which have extended beyond the point of origin are cured by the Wertheim operation. The operation is one of great technical difficulty attended by a considerable mortality and with frequent and annoying complications. Under these circumstances we must consider whether the destruction of the local lesion by radium without mortality and without complication does not offer advantages over the radical operation.

In considering this question I do not wish for a moment to decry the merits of radium. I have observed personally some most encouraging results from its use in cancer of the cervix, and would agree that it is time now instead of only referring the hopeless cases of cancer of the cervix for radium, to refer for treatment with radium alone a limited series of early and operable cases. Radium has doubtless earned for itself the right to a fair and full trial alongside of surgery. No one would welcome more than the surgeon something better than the Wertheim operation. It is to be hoped that radium will fulfil the expectations of its advocates in this regard, but as yet it cannot be said to have proved its position. Until this is done I wish to protest against the discarding of the operation of radical abdominal hysterectomy in cancer of the cervix. This much-maligned operation is not the surgical *blé noir* which it has been generally considered. It has proved itself of real curative value in hundreds of cases in the past and is capable of still better record in the future I believe.

It has been urged that when cancer is limited to the cervix, simple complete hysterectomy either vaginal or abdominal, without the extended dissection of the Wertheim operation, is adequate, and that when the disease has progressed beyond these limits surgery is not worth while. Dissection of the pelvic lymph-nodes as originally advocated by Wertheim is not endorsed by the majority of operators in this field at the present time. It seems to offer too little chance of success to warrant the increased expenditure of time and enhanced risk.

CASE II.—A. L. B. Hospital No E S 212,108. A married woman, fifty three years old entered the Massachusetts General Hospital on December 11 1916. She had been twice married and had 3 children two died in infancy 1 was living and well no miscarriages. Menopause at forty-seven. For four years previous to admission she had complained of a heavy feeling in the pelvis with backache, and later pain in the left lower quadrant. Two months previous to admission she first noticed a brown watery discharge. She consulted a doctor on October 19th and entered the hospital on December 11 1916. On examination there was a nodular growth involving the cervix, with slight involvement of the vaginal wall. The uterus was movable. Radical abdominal hysterectomy was done the internal iliacs were not tied. A liberal amount of parametrium and vaginal wall was removed with the uterus. Dr H F Hartwell reported "Epidermoid carcinoma of the cervix, with infiltration into the parametrium. The patient made an uneventful recovery. She was last seen on May 29 1920. She was working daily in a shoe factory vamping shoes, and had not lost a day's work in three years. On examination, the abdominal scar was solid. Vaginal and rectal examination was negative except for a smooth scar across the vault of the vagina. A letter of March 4 1921 reports that she is still perfectly well, four years and three months after operation.

Considerable series of cases of radical abdominal hysterectomy have been reported, showing very favorable results notably the much quoted report of Wertheim which was published in 1912 recording 675 cases of radical abdominal hysterectomy with an operative mortality of 16.6 per cent. and 43 per cent. of five year cures in 380 traced cases. Farrar Cobb has recently reported the remarkable figures of 57 per cent. of five year cures in 35 cases of radical hysterectomy with an immediate operative mortality of 11.6 per cent. in 60 cases. My own statistics are as follows

ulcerated mass bleeding freely on touch and fixed on the right side to the vault of the vagina. A radical abdominal hysterectomy with ligation of both internal iliacs, was done with removal of parametrium and a liberal cuff of vaginal wall (Fig. 300). The specimen was examined by Dr. H. F. Hartwell, Clinical Pathologist of the Massachusetts General Hospital, who found squamous-cell carcinoma of the cervix, with invasion of the right parametrium (Fig. 301). The patient made good con-

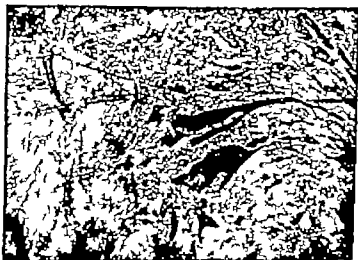


Fig. 301—Photomicrograph of section of parametrial tissue taken at point indicated by arrow in Fig. 300.

valence except that pyelitis supervened on the thirteenth day with some leakage of urine which it was feared might be due to fistula this ceased, however in a few days and gave no further trouble. She was last seen on March 22 1921 four years and eight months after operation. Her general health was excellent she was working hard daily caring for her large family. There was some distension of the recti muscles, with considerable rectocele and cystocele. Examination of the pelvis was otherwise entirely negative.

of cancer at an earlier stage of the disease. The signs and symptoms of the early manifestations of the disease in various localities have been graphically described and the fact emphasized that cancer in its early stages is a local disease, capable of being cured by early and radical operation. It is obvious that in order to advance this campaign in cases of cancer of the uterus surgeons should show first, that the primary operative mortality is not excessive, and second, that there is a reasonable chance of ultimate cure. Otherwise patients will continue to delay as they have done in the past until driven to the surgeon in the desperation of relentless pain and hemorrhage.

The estimated mortality for 1914 in the entire United States from cancer of the female generative organs was approximately 12,000. Of these cases cancer of the cervix made up probably nearly 90 per cent. Inasmuch as the annual increase in the death-rate of cancer is estimated at 2½ per cent by competent authority it would be fair to assume that at the present time at least 1000 women die every month in the United States as a result of cancer of the uterus. It is equally fair to assume that for every case that ends fatally a new case is developing and hence 1000 new cases of cancer of the uterus are developing in the United States every month.

In the very great majority of these cases the primary involvement is in the cervix of the uterus, an organ accessible to inspection and palpation by the simplest of examinations. Why then should it not be possible to detect a fair proportion of these cases in the early stages? That such is not the case however is only too well known. The majority of such cases are far advanced when they reach the hands of the surgeon. An operability of 50 per cent. that is, for the radical operation, has seldom been reached in any of the large clinics of the world. The figures range all the way from 10 to 40 per cent. The insidious nature of the onset of the disease is perhaps the principal cause of the low operability. Disinclination or dread of examination on the part of the patient, as well as a feeling of hopelessness on the part of both patient and doctor are also contributing factors in the delay.

Total of personal cases at the Massachusetts General

Hospital	64
Hysterectomies	27
Operative deaths	3—11.1 per cent.
Palliative operations	34
Operative deaths	1
No operation	3
Operability (radical operation)	—42 per cent

Cases available for end-result data

Radical operations prior to May 1917	20
Alive and all over eight years	1
Died of cerebral hemorrhage without signs of recurrence seven years after operation	1
Alive and well over four years	6
(One of the above cases, reported all by letter four years and four months after operation, shows beginning local recurrence at end of fifth year	1
Recurrences within one year	8
Untraced	1
Operative deaths	3
Four-year "cure"	6—42 per cent

These figures compare not unfavorably with the results obtained in operations for cancer elsewhere in the body in respect to both percentage of cures and operative mortality. The latter while still high as compared with that of cancer of the breast, is distinctly lower than that obtained in cancer of the stomach or rectum. It is in operability that the figures for cancer of the uterus fall down. There is a marked variation in the figures of different surgeons, but, taken as a whole, the operability is lower than for other regions of the body except the stomach. If the surgeon finds 35 per cent. of his cases suitable for radical hysterectomy and obtains a five year cure in 35 per cent. of those so operated upon, he is curing only 12 patients out of 100 seen.

The crying need then, is to get the cases earlier and thereby increase the operability. This is universally recognized. How is it to be done?

For a number of years there has been a well-organized, energetic, and far-reaching campaign carried on in the profession and among the laity with the hope of securing recognition

certain types of lesions of the cervix which predispose to the development of cancer? Undoubtedly there are, but just what they consist in is beyond my personal knowledge. We are accustomed to regard with suspicion and to advise amputation or repair in cases which have passed the child-bearing period in which there are deep, indurated lacerations with eversion and ectropion, bleeding on touch. Many of these suspicious cases have been subjected to operative repair and specimens removed for examination during the last two years but in no case as yet has carcinoma been found in the cases regarded as merely suspicious. In spite of this negative evidence there is encouragement for the pursuance of this policy in the history of a recent case.

Case III.—M. A. C. Hospital No. E. S., 240,557. Age forty-seven. Married. Seen in the Out-patient Department of the Massachusetts General Hospital on December 5, 1919. Chief complaint, menorrhagia. The menstrual flow had been excessive since birth of last child seven years before. She had had 7 children, no miscarriages. At the time of examination she was flowing three weeks out of every month, and had lost 20 pounds in weight. On examination there was marked rectocele and cystocele, with laceration of the cervix, which was ulcerated and bleeding. She was referred to the house with a diagnosis of diabetes and question of carcinoma of cervix and was admitted to the West Medical Service on December 5, 1919. The house record showed physical examination to be negative except for the following findings on pelvic examination: Relaxation of vaginal walls; anterior lip of cervix long and smooth, posterior lip enlarged, irregular and bleeds easily; cervix not fixed; no masses. Urine: Sugar present, 14 per cent. Blood-sugar 0.22 per cent. Wassermann negative. On December 20, 1919 she was referred to the Surgical Service for treatment of cervix. A trachelorrhaphy was done with excision of specimen. Microscopic report: No evidence of malignancy. Diagnosis: Endocervicitis with erosion.

After her discharge from the hospital she was referred to the Diabetic Clinic in the Out-patient Department. The

The earlier the case is operated upon, while the disease is still confined to the cervix, the easier is the technic of radical extirpation the lower the immediate mortality rate the less the likelihood of distressing complications, and the better the ultimate prognosis and hence, the more inclined other patients will be to accept surgical treatment.

This sequence of events might be likened to an ever-expanding spiral as contrasted to the vicious circle established when advanced cases are subjected to radical operation. Under these circumstances up goes the immediate operative mortality the chance of distressing sequelae such as fistula is greatly increased, and the percentage of permanent cures diminished hence surgery gets a bad name and patients with this disease keep away from the surgeon until driven to him by pain, by which time there is but little chance of cure.

Systematic examination of women who have borne children at the time of the menopause, or whenever irregular bleeding occurs, has been advocated. This is rational it can be carried out to a certain extent, and a number of unmistakable carcinomas would doubtless thereby be discovered. It is in the detection of early carcinoma that routine examinations of groups of presumably healthy adults has its chief value. But it must be remembered that a cancer clinically undetectable at one time may in six months have become inoperable. Such a case has occurred in my own experience. Is it possible to go further and determine what is the suspicious or precancerous cervix. This is difficult ground, and presents great practical obstacles. At the Massachusetts General Hospital some 30,000 new cases are examined annually in the Out-patient Department. Of these nearly one-half are women. There were in the year 1919 38 cases of definite malignant tumors of the female genital organs detected. These were all well-marked cases, capable of easy recognition. How many women may have passed through the clinic who were about to develop carcinoma? What is the precancerous cervix how can it be recognized, and how should it be treated. It is obviously impractical to repair every laceration of the cervix after child-birth. Are there

done, with ligation of the internal iliacs. The uterus, with a generous cuff of vaginal wall and a fair amount of parametrium on each side, was removed. The patient was discharged from the hospital on February 18th in good condition. Microscopic examination of the uterus showed typical early carcinoma of the cervix (Figs. 302-303)



Fig. 303.—Case III. Photomicrograph showing infiltrating carcinoma of cervix.

In this case it is interesting to note that there was clinical suspicion of malignancy before it could be established by the microscope. It is interesting to speculate as to what the results of an amputation of the cervix flush with the vault of the vagina at the time of the first entry into the hospital would have been. My personal feeling is that such a procedure would have prevented the incidence of carcinoma in this case.

diabetic condition was a mild one which yielded promptly to treatment.

On December 22, 1920 examination of the cervix in the Out-patient Department showed on the posterior lip a granulating area the size of a dime hard to the touch, bleeding easily and raised above the surrounding surface. It was believed

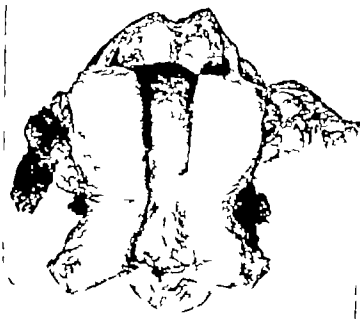


Fig. 302—Case III Showing localized carcinomatous lesion on cervix.

to be very suggestive of malignancy and the patient was again recommended to the house.

During the past year she had had the usual prolonged menstrual bleeding and, in addition, during the last six months had noted a small amount of blood on the napkin at all times. No pain. No leukorrhea.

On January 27 1921 radical abdominal hysterectomy was

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CONGENITAL HYPERTROPHIC PYLORIC STENOSIS

THE condition of pyloric stenosis of infancy has come to be more clearly defined than in the past, and with its definition and employment of suitable treatment unquestionably many infants lives have been saved which formerly would have been lost under rather vague diagnoses, such as marasmus.

That the condition is of congenital origin has been firmly established by its being found in the fetus by several observers. The reason that its symptoms do not usually manifest themselves before the tenth day is not entirely clear. The most plausible theories are that with the increased amount of food and possibly larger curds the mucous membrane inside the unyielding pyloric tumor becomes somewhat thickened and causes almost complete obstruction in the opening which during the first few days of life was sufficient to let small amounts of milk through.

The findings of some surgeons that the tumor increased in size and hardness with the age of the patient has not tallied with my observations. Some of the largest tumors causing the most complete obstruction have been found in the youngest patients. In fact the patients who come to operation late are usually those who have the lesser degree of stenosis and show a smaller tumor. In the past there has been considerable discussion about pylorospasm and true pyloric stenosis. Holt's teaching that there is no such thing as pylorospasm, these cases being mild degrees of stenosis has been quite broadly accepted. Though this discussion may have been the result of a confusion of terms it seems to the writer that not only

introduced through the mouth into the stomach. This is done as a routine to facilitate etherization. If this detail is omitted etherization is sometimes difficult, presumably due to pressure of a dilated stomach on the diaphragm. A high rectus incision was made and the pylorus delivered into the wound. The pylorus presented quite a large hard tumor. It was rotated downward until the bloodless area almost opposite the greater



Fig 304.—x Ray of bismuth meal of Case I

curvature was uppermost. An incision was now made longitudinally deep into the pyloric muscle from its duodenal to its gastric end. When the incision was made the pyloric muscle was found to be almost cartilaginous in character and practically bloodless. With the handle of the scalpel the incision was spread until the mucous membrane could be seen. Next the ends of the thumbs were put into the incision, which was further spread until the mucous membrane pouted up above the peri-

are there considerable degrees of variation of stenosis but also a distinct class of case which may be properly termed "spasm."

When the operation of pyloroplasty was first introduced it seemed as though it should relieve what we had been accustomed to call "pylorospasm" cases. The writer operated on two such patients and found the pyloric muscle though quite as large as some of the true stenosis cases, soft, vascular and moderately difficult to free from the mucous membrane. Though symptomatically these patients resemble the stenosis cases closely the difference in findings at operation as well as the difference in x-ray picture justifies the distinct classification.

With the marked degree of stenosis the history and physical examination give such a clear and definite picture that the diagnosis presents few difficulties.

Case L.—A breast-fed baby three and one-half weeks old did fairly well for the first ten days, when he began vomiting some of the feedings. At two weeks the vomiting had increased and the baby had not regained his birth weight. At three weeks he vomited every feeding. The vomiting came soon after nursing was forceful in character projecting the milk 3 or 4 feet. The baby had lost weight rapidly—6 ounces in the last three days. The stools were infrequent and scanty in amount.

On physical examination the baby was seen to be thin, the skin loose and somewhat dry, the fontanels slightly sunken. The epigastrium prominent and large peristaltic waves seen running across it. Just under the border of the liver and to the right of the midline a tumor about the size and shape of a small olive was felt. Examination of the baby otherwise was not remarkable. x-Ray of a bismuth meal shows a large stomach with the characteristic large rounded pyloric end and no bismuth passing through to the duodenum (Fig. 304). This patient presented all the characteristic features of pyloric stenosis of marked degree and operation was therefore decided on.

The baby's arms, legs, and chest were wrapped in flannel bandages and the baby placed on a warm hot-water bottle on the operating table. A No. 14 French rubber catheter was

Case II.—The next patient is a breast-fed baby nine weeks old who did fairly well for the first three weeks of life and gained a small amount. At three weeks of age the baby began vomiting some of its feedings. From that time to nine weeks of age the vomiting progressively increased until the infant lost most



Fig. 306.—x Ray of hioworth meal of Case II immediately after ingestion, showing moderate degree of stenosis.

of her feedings, but occasionally holding one or two down. At nine weeks the baby was just under her birth weight and presented a very similar picture to the case cited above on physical examination. The x rays (Figs 306-307) show the large stomach, with characteristic rounded pyloric end and accentuated

toneal surface. This detail is important and prevents the pyloric muscle from closing up and making the result a failure. There being no bleeding, the pylorus was dropped back into the abdomen, the wound in which was closed in layers. The operation was of short duration and feeding consisted of 1 ounce of whey started one and a half hours afterward. The feeding for the first twenty-four hours after operation consisted of 1 ounce of whey hourly the next twenty-four hours, of $\frac{1}{2}$ ounce of whey and $\frac{1}{2}$ ounce of breast milk hourly. Following this the amount and strength of the food was increased gradually and



Fig. 305.—1, Method of spreading pyloric muscle with thumb and finger. 2, Wound showing mucous membrane peeling up above peritoneal surface.

the interval lengthened, until at the end of a week the baby without being picked up was breast fed at three-hour intervals. The convalescence was without incident, the stitches removed on the tenth day from a wound healed *per primam*. The baby was heard from at one year of age and had nothing unusual to report. Was considered a healthy normal baby weighing 23 pounds.

Such is the history and result to be expected in a case of pronounced pyloric stenosis operated on by pyloroplasty while still in moderately good condition.

the infant is *in extremis* and when so done yields most gratifying results.

Case III.—The third case I wish to cite is of a baby eighteen days old, partly breast and partly bottle fed. This baby has not done well since birth. He started vomiting on the fourth



Fig. 302.— Ray of bismuth meal of Case III one-half hour after ingestion, illustrating pylorospasm.

or fifth day and as he vomited the breast milk his doctor tried weak modifications, which were likewise vomited. The baby was much under weight, thin, fontanelæ depressed and the skin loose and dry. On examination of the abdomen, peristaltic waves were seen in the epigastrium crossing from left to right.

peristaltic waves, but with a moderate amount of bismuth passing through to the small bowel. This baby was operated on by the same method as used in the previous case mentioned. A moderate sized pyloric tumor was found. The convalescence



Fig. 307 — Ray of bismuth meal of Case II two hours after ingestion, showing moderate degree of stenosis.

was uninterrupted but for occasional regurgitation of small amounts of milk during the first week after operation. The ultimate recovery was complete. This case represents the type of stenosis of moderate degree which is likely to become complete at any time, and for which operation should be done before

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Fig. 303.— Ray of barium meal of Case III one-half hour after ingestion, illustrating pylorospasm.

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The epigastrium was however much less prominent than in either of the preceding patients. No tumor could be felt. x Ray (Fig 308) shows the pyloric end of the stomach much smaller and less rounded than in either of the other two and considerably more bismuth passing through. A No. 14 French catheter was passed through the pylorus, as evidenced by the obtaining of bile through the tube. This patient was not operated on, but put in charge of a good pediatrician, who has reported that the baby is doing well with careful feeding. This patient the writer has classified as pylorospasm. Though she had many points of similarity to the stenosis cases, there are still distinct differences in the physical examinations in the x-ray findings and, the writer believes, in the pathology.

Though in the great majority of cases the history is so characteristic and the physical examination so definite that a diagnosis of stenosis can be made without other aid in such cases I would be in entire accord with the point of view expressed by Downes, that the use of the Roentgen ray is not necessary and sometimes even *unwise*. However I am also fully convinced that there are border-line cases in which the use of the x ray or duodenal tube or both, may establish the correct diagnosis and the suitable treatment with more precision and safety and less waste of time than by experimenting with feeding as he suggests. It would seem that Downes had been unduly influenced against the use of the x ray by an unfortunate death resulting from the delay caused by an unnecessarily prolonged observation of a bismuth meal. Three or four hours is sufficient time to gather almost all available data regarding the infant's stomach, while two or three hours will often give sufficient data to justify one in deciding for or against operation. Likewise evidence gained from the duodenal tube in a few minutes may be sufficient to make one decide against operation. The use of the duodenal tube should not be confused with the repeated passage of a stomach-tube for the purpose of determining gastric retention. This practice may be not only *unenlightening* but very exhausting and harmful to the patient.

Given an infant with pyloric stenosis, what treatment should

be employed? In the past the results of surgery were so uncertain that pediatricians were rather loath, and quite properly so to recommend it. At present the results are so uniformly successful that no one should hesitate in recommending operation for the relief of this condition. This change has been brought about by the simplification of the operation and attention to the details in its performance. Posterior gastro-enterostomy which has successfully relieved some patients in the past, was found to be too formidable an operation, and has been practically entirely discarded. The operation of pyloroplasty as now done has been evolved as the result of work done by Fredet Webber Ramstedt, Keefe, and others, and as such does not warrant the attachment of any one man's name to it. The writer performs this operation in practically the same way so clearly described by Downes, except that in spreading the pyloric muscle I use the thumbs and fingers instead of artery clamps. This slight variation is not one of great importance and though my method seems safer and less likely to damage the tissues, it is, after all, largely a matter of personal equation with the individual operator whether it should be adopted or not. This operation is as simple as it can be, accomplishes its results—namely the relief of obstruction with the minimum of shock—and is unquestionably the operation of choice at the present time. Straus reported most excellent results from a somewhat complicated pyloroplasty. In spite of his reported excellent results his operation must be more time consuming and cause more handling of the stomach and consequent shock, and has no obvious advantage over the simpler procedure.

The anesthetic and anesthetist are important factors in the success of the operation. Whereas some years ago some difficulty was experienced in the administration of ether recently with an anesthetist of experience in these cases, and with routine practice of introducing a catheter into the stomach during the anesthesia, no difficulty has been encountered. The operation may be done under local anesthesia, but only with difficulty and with the probability of the infant forcing the stomach and intestines out of the wound by crying or struggling. This prolongs the

The epigastrium was however much less prominent than in either of the preceding patients. No tumor could be felt. *x*-Ray (Fig. 308) shows the pyloric end of the stomach much smaller and less rounded than in either of the other two, and considerably more bismuth passing through. A No. 14 French catheter was passed through the pylorus, as evidenced by the obtaining of bile through the tube. This patient was not operated on, but put in charge of a good pediatrician, who has reported that the baby is doing well with careful feeding. This patient the writer has classified as pylorospasm. Though she had many points of similarity to the stenosis cases, there are still distinct differences in the physical examinations in the *x*-ray findings and the writer believes, in the pathology.

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Given an infant with pyloric stenosis what treatment should

pounds which is slightly above the average for a normal baby of this age according to Holt's statistics.

To sum up Pyloric stenosis of infants is congenital in origin.

The diagnosis of the cases of marked degree offers few difficulties.

The diagnosis in the cases of mild degree is more difficult, and may be determined by the aid of the x-ray or the duodenal tube or both, with more precision and less waste of time than by experimenting with feeding.

The simplest form of pyloroplasty as described by Downes, the writer and others, is the operation of choice. More complicated operations are not to be recommended.

General ether anesthesia facilitated by the introduction of a stomach-tube is the most satisfactory anesthetic.

The mortality is dependent largely upon the time at which operation is performed after the onset of symptoms and may be reduced by obviating unnecessary delay.

The following up of patients after operation has showed the end results to be as gratifying as the immediate

operation and increases the shock. On the whole, the disadvantages to local anesthesia *much outweigh the advantages*, and I should entirely agree with Downes that it is not to be recommended. General ether anesthesia in the hands of an anesthetist experienced with these cases is believed to be the anesthetic of choice, the opinion of Bevan to the contrary notwithstanding.

The factors entering into the mortality are the general condition of the patient, the duration of the symptoms, the amount of loss in weight, the experience of the surgeon, and the attention to details in the after-care and feeding. Downes reports 175 cases with a mortality of 17.1 per cent., which is high, but probably due to delay in his receiving the patients. Any surgeon is bound to have a high mortality if the operation is too long delayed. Downes makes this clear by showing that his mortality was only 8 per cent. in cases coming to operation within four weeks of the onset of symptoms. While Goldbloom and Spence show that the mortality was under 2 per cent. in a series of 51 breast-fed babies coming to operation, with a loss of weight under 20 per cent.

At the Children's Hospital 78 pyloroplasties have been performed, with 6 deaths, a mortality of 7.6 per cent. I have personally operated on 48 patients, among whom 2 deaths occurred, a mortality of 4.1 per cent. This mortality includes deaths from any cause while the patients remained in the hospital. Of these 48 patients, 32 have been followed after leaving the hospital and 16 lost track of. Of the 32 known about, one patient who had done very well for four months died during an influenza epidemic. Three other members of the family had influenza at the time the baby became sick. The baby either died from influenza or spinal meningitis, the diagnosis made by the attending physician. The other 31 patients are all normal and healthy. Of 20 patients over a year old, the smallest weighed 17 pounds and the largest 26½ pounds. Four patients were under 21 pounds and the rest over. The average weight at one year of the 20 patients was fraction under 22

CLINIC OF DR. TORR WAGNER HARMER

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TENDON SURGERY

THE object of tendon surgery is the restoration of function. Success in this work depends as much upon the after-care as upon the technic of operating. In the absence of an especially trained assistant the after-care demands personal supervision. Unretarded strong healing of severed tendons demands careful approximation of the severed ends by a stitch which will not destroy many tendon fibers either by transfixing or constricting and so placed that it will not pull out with early use of the tendon. In certain situations, such as the wrist, early function is imperative in order to avoid fixation of the tendons by adhesions. The original wound and the traumatism of operation however slight, will be followed by more or less connective tissue formation. If a suture is not sufficiently strong to endure early use this connective tissue formation may seriously fix the tendon to surrounding tissues. The liberation of the tendon may require weeks of massage, and perhaps complete function may never be attained. The desiderata are a dependable method of suture, operative technic which minimizes trauma, immediate active use, and intelligent after-care.

Since 1909 I have employed a method of treating severed tendons which may not be new but was not known in 1917 to a number of surgeons to whom I had spoken. Accordingly in this year I published the method (Boston Medical and Surgical Journal, December 6th) giving in detail its application in a boy of five who had severed all the tendons on the anterior surface of the wrist. The case (Figs. 309-318) had been operated upon in 1915 three days after injury *no splint* had been used, *active* motions had been started the day of the operation and a per

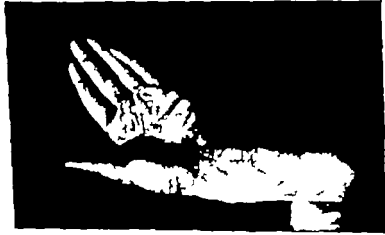


Fig 312



Fig 313



Fig 314

Figs. 312-316 (fifteen months after operation) show complete abduction, adduction, and extension of wrist, and complete flexion, extension, abduction, and adduction of fingers.



Fig. 309

Fig. 310

Fig. 311

Figs. 309-311.—Before of all tendons on the anterior surface of the wrist in (lifting upon glass bottle). Figs. 309-311 show the amount of abduction, adduction, and extension of the wrist and flexion of the fingers twenty-three days after operation. The operative extension of the wrist through the annular ligament into the palm is shown.

fect functional result had been obtained. Since the publication of this paper some modifications in after-care have been made, but the method of suture and the principles of technic have not been changed.

The *stick* is of silk or fine linen, and consists of overcasting the lateral margins of both ends of the divided tendon. The



Fig. 317



Fig. 318.

Figs. 317 and 318 (5 years after operation) show complete function of the hand. There is no interference by adhesions either in flexion or extension; in fact hyperextension of the fingers is possible.

overcasting is started about the width of the tendon, or a little more back from the line of division each loop including somewhat less than one-quarter of the diameter of the tendon. When a tendon is ready to be brought together each end then carries two stitches and each stitch two ends, as shown in Fig. 319. In this figure although the short ends are shown partly knotted,



Fig. 316.



Fig. 315.

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they have been represented still threaded in the needles in order to indicate the direction in which the stitches have been placed. The full length of the long ends has not been shown in order to

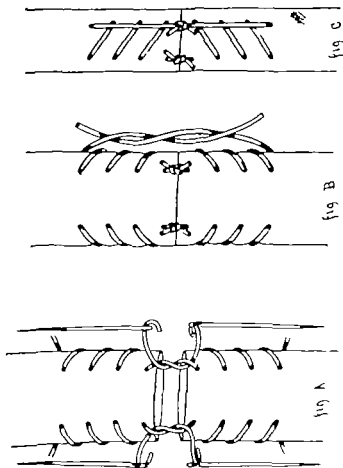


Fig. 319.—Diagram of method of suture

simplify the diagram and the weight of the suture material has been exaggerated for clearness. If there be more than one tendon severed, stitches are placed in all before any are tied. The

assistant holds the part in an appropriate position to facilitate approximation of the tendon ends and the sutures nearest the line of division are tied. The long suture ends are then tied. In Fig 319 *B* the constrictions of the edges of the tendon beneath the overcasting stitches are exaggerated. In this figure both pairs of short ends have been tied, one pair of long ends is being tied, and the other pair of long ends has been tied, but is out of view on the under surface of the tendon. The long ends so tied alongside the tendon serve as lateral splints. The objection that they occasion too much suture material in the wound is refuted by the fact that I have never seen any harm from them. It is likely that these lateral stays become incorporated with the sides of the tendon just as silk strands in tendon bridging. Sometimes after tying the stitch, the severed ends, although in contact, may slightly buckle. This is caused by tying the long suture ends too tightly. They should simply be made taut. The error may be readily corrected by placing a simple stitch on the anterior surface between the tendon ends. There is no tension on this simple stitch. It merely closes the gap caused by the buckling. Figure 319 *C* is a side view of a sutured tendon. It shows how the tying of the two shorter ends tends to splint the tendon on its upper surface and how tying of the two longer ends tends to splint the tendon on its under surface. The tendon shown is a well-rounded one, and consequently the overcasting includes only a part of the lateral margin. In case of a flat tendon it would include practically the whole thickness of the lateral margin.

Examination Before Operation—A knowledge of the problem at hand should be determined before operation. This does *not* mean examination of the wound. This should be kept covered with sterile gauze. It implies quickly testing the function of the parts. This is best done by instructing the patient what you wish him to attempt and then very gently resisting the expected motion. In testing for the integrity of mixed nerves the mental attitude of the patient may render cutaneous sensation tests unreliable. In testing the integrity of the median and ulnar nerves in injuries to the anterior surface of the wrist it is

unnecessary to recall that the muscles of the tendons are innervated at a higher level in the forearm. It is therefore necessary to test quickly the action of the *interossei* and the *muscles* of the *thenar* and *hypothemar* groups.

Technic of Operating—No tourniquet is used. In extensive tendon injuries the operation is necessarily long. The protracted constriction may not only affect the nerves, but the interference with circulation may so disturb the nutrition of the parts that healing may be retarded and resistance to infection reduced. Furthermore, prolonged use of the tourniquet may be followed by postoperative oozing which is undesirable in work of this kind. If a tourniquet has been applied to control hemorrhage, it is removed as soon as the bleeders have been secured through a wide exposure.

Iodin preparation has proved entirely satisfactory. This is fortunate because its application entails but very little disturbance of the parts. Soap and water preparation, for example requires considerable movement of the hand, wrist, and fingers, which may cause marked retraction of severed tendons.

In recent cases with jagged wounds débridement of the wound edges with a sharp knife is done, sacrificing a minimum amount of skin and fascia. The knife, forceps, and hemostats used for the débridement are at once discarded from the operative kit. If no débridement is necessary immediate generous exposure of the injured area is secured. For example, in case of a transverse cut on the anterior surface of the wrist in which it has been demonstrated prior to operation that the deeper tendons are injured, incisions are at once made through the annular ligament into the palm and several inches up the forearm. It is well to make incisions through the skin and deep fascia separately because at the close of the operation these structures are to be sutured separately. Through this wide exposure the parts *in situ* are studied. Nothing is moved or disturbed until the corresponding ends of the superficial structures have been identified. The overcasting stitch of silk or fine linen is then applied to the lateral margins of these tendon ends. The four suture-ends connected with each tendon-end are clipped together in a snap as

soon as applied. When all the tendon ends of the superficial layer have thus been supplied with sutures, they are turned back out of the field to expose the deeper layer. With this deeper exposure the parts are again *in situ* studied. Nothing is moved or disturbed until the corresponding ends of the structures are identified. The overcasting stitches are then applied to these tendon-ends. When all tendon-ends have thus been provided with sutures the corresponding ends are tied together as previously described, beginning with the deepest and working toward the surface. The assistant will relieve tension on the sutures by holding the part in appropriate position.

The nerves may be accurately brought together by simple sutures which barely catch their edges, and inasmuch as no tendon is to be put upon them, very fine needles and silk may be used. We wish merely to hold the nerve ends in approximation, and therefore our suture material may be very delicate and the bites of the suture very tiny. A simple suture is effective and obviates the more numerous traumatism occasioned by manipulation during the application of a more complicated suture. It is unnecessary to state that every effort must be made to bring the nerve ends together without twisting them so that nerve bundles may be apposed to nerve bundles as far as it lies within our power to do so. We may be aided in matching the nerve-ends by the tiny vessels upon their surfaces. Bleeding of the nerve-ends must not be checked by pressure but the blood merely flooded or sopped away with pledgets saturated in salt solution. A little salt solution may be dripped upon the nerve as the approximation is being made to prevent the inclusion of old clot between the nerve-ends.

Whether we are dealing with tendons or nerves we must handle them as little as possible. The tendon may be held once to apply the first stitch. When this is tied it is used as a guy line to steady the tendon during the application of the rest of the stitch. Although the technic may be criticized, I prefer to hold the structure with a piece of moist gauze in my fingers rather than to subject it to the uncertain compression of a smooth forceps, the bite of a toothed forceps or the tearing of tiny hooks.

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severed ends are objectionable as foreign bodies which thwart normal repair. Scar tissue between tendon ends will not endure early motion without stretching. I have observed a gap occasioned by injudicious passive motion of recently united tendons bridged by scar tissue. In old healed cases in a number of instances I have observed gaps between tendon ends bridged by scar tissue. This must all be removed for it tends to stretch. One instance where there were two long gaps so bridged by scar rather than graft, I fashioned the scar tissue after separating it from surrounding tissues, excised redundant portions, united as usual, and then reinforced the scar tissue edges with a fine overcasting stitch of silk. It looked very pretty. No splint was used. Active motion was started at once. It worked well, but only for a very short time not because the sutures pulled out, not because the structures became adherent, but because the scar tissue bridges very soon stretched and loss of motion over very considerable arcs resulted. It is important, then, to have *nothing between the tendon ends and to have them snugly approximated*.

The surgery of old healed cases may demand considerable ingenuity and some knowledge of the behavior of tendon, skin and bone-grafts. I have advisedly not mentioned the grafting of nerves because defects in their continuity may usually be connected by direct end-to-end suture after adequately freeing up the nerve and holding the parts in the most relaxed position. This can usually be accomplished and is preferable to the introduction of tissue tunnels or sleeves to encourage the direction of the regenerating fibers.

Recent cases with mangled, dirty wounds must be treated like any septic wound with special attention to the prevention of contractures and joint ankyloses. The case then falls into the category of old healed cases, but is in better condition for reconstructive operating than the usual neglected cases. At an appropriate stage in the granulating of large septic wounds it may be better judgment to cover with a pedicle flap for example from abdominal wall to back of hand. This will prevent the formation of thin firmly adherent new skin which usually has to

After the first suture has been placed the structure can be readily handled by it rather than by the use of instruments. I am strongly opposed to any instrument which compresses the structure during the application of the stitch or during the apposition of the ends in tying together. If no nerves have been sutured, it is well to test the strength of the tendon sutures by slowly and gently flexing or extending the part before closing the fascia interruptedly with fine linen or silk. Small bleeders in the subcutaneous tissue will by this time be thrombosed. If any need be tied it may be done with No. 00 plain catgut. The skin is closed interruptedly with fine silkworm-gut. No drainage of any kind is used, not even strands of silkworm-gut. A light dry dressing and a splint which fulfils the criteria to be described are applied.

In recent cases the tendon or nerve ends may be frayed. In old healed cases the tendon or nerve ends are involved in scar tissue. In both instances the ends require preparation for suture. In the first instance to expose undamaged tissue, and in the second to expose normal tendon or nerve structure. In either instance this is to be accomplished by clean-cut cross-sectioning with a sharp knife. Scissors traumatize the structures by crushing them.

It is unfortunate that any suture material need be used. Inasmuch as this is an unavoidable necessity let the material be as fine as possible and as small in amount as possible. It always acts as a foreign body and provokes tissue reaction. That this tissue reaction does not result in adhesions which limit the movement of the tendons, early use of the parts is imperative. That connective tissue develops about the sutures we cannot avoid, but that this connective tissue become adherent to surrounding structures we can avoid by early motion. Inasmuch as we cannot prevent the formation of connective tissue about suture material, and inasmuch as we can prevent its adherence to surrounding tissues by early motion, it is wise that the suture material be applied as much as possible to the external surfaces of the tendons. Any knots which lie between the approximated ends, or any sutures which pass through the

knuckles were bridged by sections of the palmaris longus of the same arm. These grafts were carried through tunnels in the fat of a free skin-and fat transplant from the abdomen to the back of the hand. The fourth and fifth extensors were merely freed from scar tissue. After operation marked flexion of the fingers and wrist were restricted by a splint, but active extension was permitted from the beginning. Most of the fat of the graft melted away and a considerable portion of the skin became gangrenous and separated. However the tendon grafts lived, and as the figures show there is now present complete flexion of all fingers, complete extension of the second, fourth and fifth and almost complete extension of the third. Extension of the third finger is not quite complete because the length of the tendon graft from the palmaris longus was not properly estimated at the time of operation. The graft was a little too long and in consequence there is now a little slack which prevents extreme extension. The injury was a mangling accident some months prior to operation, and all the fingers had been held in semiflexion, prevented from complete flexion by scar tissue on the back of the hand, and from complete extension in part by extensive loss of tendon and in part by anchoring scar.

Small tendon defects, especially in the region of the distal phalanges, may be nicely bridged by a number of silk strands. The most gratifying result of this type was in an academy student. Through a rectangular flap of skin embracing the distal and middle phalanges of the ring finger with a pedicle along the ulnar side, the profundus tendon with a considerable gap across the distal joint was exposed. This was bridged with silk strands and next season the student resumed playing both baseball and football. These small problems about the terminal phalanges are often quite as perplexing and their successful solution quite as gratifying as more serious injuries.

Splinting and After-care—The after-care is quite as important as the operation. With a reliable method of suture success depends chiefly upon immediate active motion to prevent anchoring adhesions. No splint which limits active motions

be sacrificed at any subsequent operation because it is impossible to turn it back as a viable flap.

In case of considerable loss of tendon transplantation may be resorted to to avoid grafting of fascia or excised tendon (cf. *palmaris longus*). For example, the proximal parts of the *sublimis* tendons of the palm may be united to distal parts of the *profundus* tendons or proximal parts of the *extensor* and *metacarpal pollicis*, *extensor brevis pollicis*, or *extensor carpi radialis longior* may be united to the distal part of the *extensor longus pollicis*, etc. The technic of suture however differs in no way from that of traumatically severed tendons. The freeing up and shaping of scar tissue with which nature has attempted to repair a gap is not reliable as previously cited. Defects of considerable length, such as may occur in mangle accidents of the hand, may be filled by the use of grafts of fascia or excised tendon. Fascia may be secured from the iliotibial band. Tendon may be secured by excising the *palmaris longus*. The *plantaris* would be ideal, but we have no way of previously demonstrating its presence. There may be injuries to bones. This may be in the form of defects requiring bone-grafts or in the form of exuberant callus or spurs which already deflect the course of adherent tendons or would deflect the course of tendon transplants. I have encountered one case (Figs. 328-330) in which untoward new bone formation following old compound fractures of the metacarpals held the *extensor* tendons of the index-finger fixed and distorted. After freeing the tendon from this "rocky bed" it was found to be too long. The bony overgrowths were removed and the tendon shortened. Figure 330 shows that complete extension of this finger cannot be accomplished. There is a little too much slack in the tendon. Further shortening at the time of operation would have been desirable. The fingers had been held in flexion for eight years. The result is a great improvement, but not perfect. The difficulty of exactly estimating the length of a tendon, be it shortened or lengthened, or grafted, is well known to all who have worked in this field.

Figures 331-333 illustrate a case in which defects of the *extensors* of the second and third fingers from the wrist to the

day as the operation the patient is encouraged to use actively the sutured tendons, and the opposing muscles gently within the scope permitted by the splint and is forbidden to use passive motion. The dressing is rapidly reduced in bulk during the next few days so as not to interfere with motion. In a day or two the motions executed by the sutured tendons are performed passively to permit the patient to see the amount of motion that can be safely accomplished. The motions executed by the tendons of the opposing muscles may be passively performed with great gentleness. I do not delegate this passive motion to anybody for ten or twelve days. The patient and those in attendance are enjoined not to do so. Within seven to ten days the splint may be omitted. In twelve or fourteen days the services of a mechanotherapist are started (massage and gentle passive motion in both directions). With active function of the sutured tendons from the beginning it is surprising with what rapidity the tendons resume their strength. The intelligent co-operation of both masseur and patient is at this time of extreme importance.

In cases in which nerve suture has also been necessary some device to prevent tension on the nerve must be worn day and night, for six or eight weeks. In case of suture of the nerves at the wrist this may be conveniently accomplished by the use of an aluminum gutter splint, as previously described, extending from the knuckles half-way up the posterior aspect of the forearm bent at the wrist to maintain slight flexion padded with felt, and held in position by webbing buckle straps attached to the splint. A splint of this type is light, not cumbersome, and readily removed and applied. This facilitates the services of the mechanotherapist. When removed by the masseur both he and the patient must understand that the fingers may be extended and flexed, and the wrist may be flexed but the wrist must not be extended either actively or passively beyond the point which is possible when the splint is in place.

Critical examination of the cases illustrated by the accompanying figures will demonstrate I believe, the importance of very early active function. It will demonstrate also I believe,

of the sutured tendons should be used. In many cases no splints are necessary and this was my practice until recently in all cases uncomplicated by nerve suture. Two accidents have demonstrated the prudence of restricting the pull of opposing muscles in vigorous, energetic individuals. In one instance drawing up the bedclothes during sleep pulled asunder one of two extensor tendons sutured that day. Active motion of both tendons had been present in the evening but was discovered absent in one on waking in the morning. Had too forcible flexion of the fingers been prevented by splinting, this accident would not have occurred. Resuture was necessary and, fortunately was entirely successful. In case the flexor tendons at the wrist have been united, it is well to limit *extension* of the phalanges and carpus. The splint, however should in no way restrict *flexion* of the phalanges and carpus. This may be conveniently accomplished by a posterior gutter splint of aluminum extending from the fingers up the forearm, bent at the wrist to maintain slight flexion, padded with felt, and held in place by webbing buckle straps attached to the splint. The straps about the forearm and above the wrist may be snugly buckled, but the strap across the palm only loosely applied in order to permit slight flexion at the wrist. There should be no strap across the fingers. In case such a splint is not at hand, a device may be readily improvised consisting of a straight posterior splint of wood with the portion distal to the wrist built up with folded towels secured to the splint by adhesive straps.

Active use of united tendons begun as soon as the patient has recovered consciousness from the anesthetic will *not* pull out a dependable suture. Overvigorous pull of opposing muscles may partially separate united tendons. Passive motion must be forbidden for twelve to fourteen days. No person will use a sutured tendon too vigorously. A few persons will use the opposing muscles too vigorously. Restriction of the activity of the sutured tendons is, therefore, not only unnecessary but undesirable. Partial restriction of the use of the *opposing* muscles is therefore wise for a week or ten days. On the same

day as the operation the patient is encouraged to use actively the sutured tendons, and the opposing muscles gently within the scope permitted by the splint, and is forbidden to use passive motion. The dressing is rapidly reduced in bulk during the next few days so as not to interfere with motion. In a day or two the motions executed by the sutured tendons are performed passively to permit the patient to see the amount of motion that can be safely accomplished. The motions executed by the tendons of the opposing muscles may be passively performed with great gentleness. I do not delegate this passive motion to anybody for ten or twelve days. The patient and those in attendance are enjoined not to do so. Within seven to ten days the splint may be omitted. In twelve or fourteen days the services of a mechanotherapist are started (massage and gentle passive motion in both directions). With active function of the sutured tendons from the beginning it is surprising with what rapidity the tendons resume their strength. The intelligent co-operation of both masseur and patient is at this time of extreme importance.

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Critical examination of the cases illustrated by the accompanying figures will demonstrate I believe, the importance of very early active function. It will demonstrate also I believe,

the reliability of this stitch, one which may be depended upon to tolerate early function, and thus obviate in a great measure the formation of adhesions. The identification of tendons, the minimizing of operative traumatism the preservation of grooves or gutters of tissue about which tendons working at an angle may play the use of skin fat, fascia and bone, make this one of the most practical and fascinating fields of surgery I trust that the method above described may meet favor in other hands no tourniquet the overcasting stitch, dry wound, separate closure of fascia and no restriction of immediate active function of the severed tendons.



Fig. 320.—Foot in repose.

Fig. 321 —Toes in extension.

Figs. 320, 321 (seven months after operation).—Suture of extensor tendons of fourth and fifth toes performed immediately after injury by lacerated wound by axe opening the metatarsophalangeal joint and fracturing the phalanx. Suture and immediate closure. Rhoeo drainage followed by infection necessitating opening the outer two-thirds of the wound. Wound healed by granulation without damage sutured tendons (Mass. General Hosp. Records, E. S. 236,577.)



Fig. 322 shows extension and action of 1 forearm. Fig. 323 shows action of fingers. Fig. 324 shows adduction at wrist and extension.

Figs. 322-326.—Suture of volar and ulnar nerves, flexor carpi ulnaris, all 1 profundus, two 1 sublimis, and palmaris longus tendons, performed twenty-four hours after injury (throwing iron through pane of glass). Photographs taken six months after operation. (Mass. General Hosp. Records, E. S. Vol. 1493, p. 51.)



Fig. 325.

Fig. 326.

Fig. 327.

Fig. 325 shows action of profundus tendons.

Fig. 326 shows extension of fingers, indicating slight limitation in extension of ring-finger. Also shows how far laterally the wound extends.

Fig. 327 — Action of extensor tendons of second and third fingers performed few hours after injury (adjoining blow with an axe, opening the third metacarpophalangeal joint, and nearly sectioning the second metacarpal bone). Patient takes one month after injury too. Shows some limitation in extension of fingers owing to stiffness from injury to bone and joint. (Mass. General Hosp. Records, E. B. 341933.)



Fig. 328.



Fig. 329



Fig. 330 shows some limitation in extension of forefinger due to little too much slack in the tendon. Further shortening of time of operation

Figs. 328-330.—Old compound fractures of metacarpals with severed extensor tendons. Shortening of extensors of second finger and suture of extensor of third finger performed eight years after injury (compound fractures of second and third metacarpals from crush by gears of wind-mill). Since this time the second and third fingers had been carried in flexion. Pictures taken ten months after operation. Tendons found buried in scar tissue and adherent to metacarpals. Impossible to distinguish between extensor communis and extensor indicis. Both fused in scar adherent to bone and distorted by exostoses. Exostoses removed, tendon shortened. Tendon ends of third finger liberated from scar and sutured.

Figs. 331-333.—Grafting of palmaris longus tendon to fill defects in extensor tendons of second and third fingers from knuckle to wrist, performed several months after injury (mangling accident). Fingers had been carried in flexion. No power of extension in second and third and very slight in fourth and fifth. Pictures taken thirteen months after operation. Thick glossy adherent skin removed from greater part of dorsum of hand. Extensor tendons of second and third fingers found extending through full length of metacarpals. Extensors of fourth and fifth fingers freed from scar tissue. Grafts from palmaris longus were run through tunnels of fat in free skin-and-fat graft from the abdomen. Most of the fat melted away. Considerable portion of skin became gangrenous and separated. Tendon grafts, however, not affected. (Mass General Hosp. Records, E. S. 235490.)



Fig. 311



Fig. 312

Figs. 311 and 312 show extension and flexion of fingers



Fig. 313 shows incision for removal of palmaris longus.



Fig. 334.

Figs. 334-336—Suture of tibialis anterior performed few hours after injury (cut 1½ heel of arm). Picturus takes seven months after injury. At operation tibialis anterior found severed, extensor digitorum longus sutured and bone inserted. Suture of tibialis anterior tendon. Patient well known master skater. Skating two and one-half months after injury and could not distinguish any difference between action of two feet. Fig. 335 shows action of severed tendon. Also illustrates some adhesion at upper angle of wound. Fig. 336 shows extension of foot.

Fig. 335.

Fig. 336.



Fig. 337



Fig. 338

Fig. 337 — Suture of tendo achillis performed several hours after accident (cut by breaking of plate glass window). Pictures taken five months after operation. (Mass General Hosp. Records, E. S., Vol. 1496, p. 53.)

Fig. 338 shows use of gastrocnemius and soleus in balancing the entire weight of the body on the toes of one foot.

CLINIC OF DRS J DELLINGER BARNEY CHARLES
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THE PROBLEM OF RENAL CALCULUS WITH SPECIAL
REFERENCE TO TREATMENT

ALTHOUGH the question of renal calculus would appear to have been thoroughly discussed from every angle the diagnosis and treatment has not yet reached a point of perfection

The impression is wide-spread that modern diagnostic methods and apparatus are able not only to indicate whether a stone is present but also the number of stones and their size and location With improvement in surgical technic it would appear to be a simple matter to extract from a comparatively small cavity every particle of calcareous deposit which it contains Investigation along these lines shows that the contrary is often the case and whereas this is true in the majority of instances there are many exceptions the sum total of which counts up with uncomfortable rapidity

The most valuable opinion is that which is based upon one's personal experience or upon the work of others with which he is thoroughly familiar It has therefore seemed valuable to review our experience with the problem of renal calculi in the Genito-urinary Service of the Massachusetts General Hospital

Our records contain 139 cases of renal calculus so proved by operation or otherwise Many other cases have been admitted with this diagnosis but sufficient evidence was not at hand in these patients to make the diagnosis undoubted, and they have not been included in this study A brief review of some of the data in these cases seem worth while

There were 108 males and 31 females, showing a definite predisposition for stone on the part of the male. Youth and old age, on the whole are immune from this ailment, and one has, therefore, to deal in most cases with an individual in the prime of life. Our youngest patient was ten years of age, our oldest, seventy years. There were 15 patients between the ages of eleven and twenty, 44 between twenty-one and thirty, 39 between thirty-one and forty, 29 between forty-one and fifty, and 11 patients past fifty years of age.

It is interesting to note how long a time may elapse from the date of the first symptom until the time when the patient seeks relief, a point which would indicate comparative silence on the part of the stone. Furthermore, although some of our patients had sought professional advice before coming to the hospital, the stone was entirely overlooked in many, and the symptoms assigned to a lesion elsewhere than in the urinary tract. In a previous communication (*Internat. Jour. of Surg.*, December 1, 1918) one of us (J. D. B.) made the observation that in "290 of our hospital and private cases, 53, or 18 per cent., had had one or more previous operations, mostly (36) on the appendix, but including almost every other abdominal organ as well. In the present series of cases 7 had had previous abdominal operations (of which 5 were for the removal of a supposedly diseased appendix) without relief of symptoms, the actual source of trouble lying in the kidney. To quote again from the article previously referred to: "The only reason for the error which the study of these records has brought to light is that in most cases no use whatever was made of the available and well-tried diagnostic measures, the surgeon relying largely upon what he could himself feel or see, or taking the evidence presented by his underlings. We have all seen right-sided calculi with high temperature, pain, tenderness, distention, nausea and vomiting, leukocytosis, and other symptoms characteristic of an acute appendicitis or other abdominal condition, and we may well forgive the surgeon who with this picture before him, perhaps in the middle of the night, and without facilities for differential diagnosis at hand gives the

patient the benefit of the doubt and operates in the belief that he is forestalling a gangrenous appendix or a general peritonitis. Should he prove to be wrong it is an ungrateful patient indeed who would not hold him guiltless.

"But when it comes to the milder conditions, or to symptoms which have dragged along for a number of years there is far less excuse for a mistaken diagnosis, and he who falls into the trap without having resorted to every diagnostic measure has only himself to blame. There are, nevertheless, certain cases of urinary calculi, some of the kidney but more of the ureter which defy every effort at diagnosis, and an operation for a supposed stone may yield negative results or an entirely different diagnosis will be made. That the symptomatology of urinary calculi is not always classical has been shown by Cabot, who in a series of 127 cases, found a persistently negative x-ray in 6 per cent. and in 150 cases a persistently normal urine in 14 per cent. This evidence is corroborated by Braasch in his analysis of 294 cases of ureteral stone. The x-ray was negative in 11 per cent. while the urine was entirely normal in 12 per cent. contained only an occasional red cell in 9 per cent., and only a rare pus-cell in nearly 3 per cent. A review of the situation both by an examination of our own records and a study of the literature convinces me that in spite of great advances in diagnosis a certain number of cases will continue to be operated upon for stone in the presence of a suspicious shadow and perhaps an equal number who actually have a calculus, will undergo operations for other conditions. Braasch reports 5 cases in the first category and I feel sure we could collect as many more were the facts investigated.

The duration of symptoms was less than a week in 4 cases and under two weeks in 3 others. Nine patients had had their troubles for two months, 18 for six months, and 8 for a year. Surprisingly enough the symptoms had lasted for three years in 39 cases, for five years in 11 cases, for ten years in 14 cases, and over ten years in 17 cases. The most long-suffering patient had fought off the inevitable for twenty-five years. All of which goes to show that renal calculus may be insidious in its



Fig. 339.—Unusually large left renal calculus, with one or two smaller stones occupying lower calices and pelvis of kidney. Stone easily palpated through abdominal wall. Kidney very movable, not adherent. Pain very slight, amounting to only dull ache, and appeared only two or three months before operation.



Fig. 340.—Single silent calculi. Pains considered to be in opposite side.

onset. Generally speaking the smallest stones gave rise to the most severe and frequent attacks of pain, leaving the task of undermining a patient's general condition by the production of pyonephrosis to large or multiple calculi.

Although it is commonly known that calculi may be 'silent' either throughout their entire residence in a kidney or for a very long period of time (Figs. 339-341) the production of pain is their habit, and it is pain which forces the patient to



Fig. 341—Multiple stones in left kidney. Shadow suggests but one stone. Pain entirely on the right side. One large stone removed through pyelotomy incision, on others felt. (See Fig. 342.)

seek relief in most instances. In 112 of our cases pain was the first symptom noted—dull in 47 sharp in 62. While we have seen an occasional example of pain in the region of the opposite kidney (Figs. 340-341) this symptom usually arises on the affected side remaining in or about the region of the kidney or quit as often radiating downward toward the groin. When so situated on the right side and when accompanied as it frequently is with nausea and vomiting pyrexia

leukocytosis, and local tenderness, the most careful surgeon even after exercising every precaution against error may find himself operating upon a normal appendix.

In 31 patients the first indication of a lesion in the urinary tract came from other directions than the kidney. Hematuria first caught the patient's attention in 10 instances, dysuria, in 5 the onset of "chills and fever" of unexplained origin drove 5 patients to the hospital while pyuria was the deciding factor in 4 frequency of urination in 3 retention of urine in 2. An unduly urgent desire to urinate caused 1 patient to seek relief, whereas the spontaneous passage of a stone sent another patient to the hospital, where other calculi were found to be still in the kidney.

Unusual frequency of urination was complained of by 43 patients, a phenomenon which may be ascribed to the irritability of the bladder neck by the passage over it of an infected urine.

While it is not believed that a "housewife" has a dangerous occupation, 23 of our patients were so occupied, shoemakers, clerks, machinists, laborers, carpenters, and students coming next in the order named. Almost every other known activity was represented by one or more patients. The question of occupation is touched upon simply to show the wide variety of the classes of people who are afflicted with renal calculi.

The great majority of cases had no appreciable amount of temperature at the time of admission to the hospital. In 44 it was normal, in 60 it was as high as 99° F while in 21 there was a temperature of from 99° to 100° F.

Pus is the most frequent finding in the sediment, as our records show it was present alone 59 times, and combined with blood 41 times, a total of 100 cases. Blood alone, generally microscopic, was found in 26 cases. Reference has already been made to the fact that in studies of renal and ureteral calculi by Cabot and by Braasch the urine was repeatedly negative in a considerable number of instances. In substantiation of this point we may say that in 12 of our cases, or 8.6 per cent., the urine was persistently negative. We feel that too much stress cannot be laid on this experience, as it may

and often does mislead the unwary into the belief that renal calculus cannot be present.

Tenderness of or in the region of the stone-bearing kidney was noted in 60 instances, and this organ was recorded as 'palpable' 19 times. It should be recalled, however that kidneys are frequently palpable, especially in women, and particularly on the right side, in normal, healthy individuals, so that too much emphasis should not be placed upon this finding. In one instance (Fig. 339) an unusually large renal stone occurring in a thin individual was readily palpated through the abdominal wall.

Roentgenograms of the urinary tract showed the presence of stone in 125 cases, and by this or other methods stones were found not only in the kidney but also in the bladder in 8 cases and in the ureter in 2. In one or two cases where the x-ray findings were negative but where the persistence and character of both objective and subjective symptoms indicated the probability of stone, operation was performed and a calculus found and removed. One case is of special interest. He was a man of thirty-five who had been seen off and on in the out-patient clinic for about two years with intermittent attacks of right sided pain, accompanied by a rise of temperature, nausea and vomiting, and tenderness in the costovertebral angle. The urine of the right kidney always, but more especially after an attack of renal colic, contained pus in considerable amount, together with microscopic blood. A pyelogram on several occasions showed what was considered a normal pelvis (Fig. 344) both as regards size and shape, and the calices were not demonstrably dilated. Still more frequent roentgenograms of the urinary tract showed no evidence of stone. We regard these observations as of special interest and importance, as during this long period of time the conditions both inside and outside the patient's body were necessarily different and different radiologists took the plates. Operation was finally performed by one of us (J. D. B.). The kidney and ureter were not abnormal in appearance. On opening the pelvis the probe at once located a stone, which after being extracted with some difficulty

proved to be like a piece of clam shell and about 2 x 1 cm. in diameter. Chemically the stone proved to be uric acid mixed with a small amount of calcium oxalate. Subsequent experiments with this calculus showed that it was impossible to conceal it from the x-ray regardless of the medium in which it was placed.

C. H. Mayo (Mayo Clinic, 1919, xi) wisely remarks that 'more careful search must be made for extra stones, since

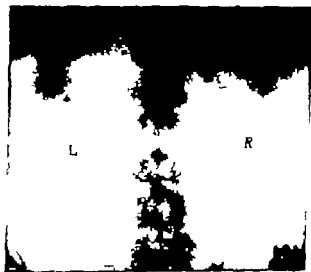


Fig. 342.—Same patient as in Fig. 340 taken during convalescence. Shows shadow of two or three more stones, not detected during operation (See Fig. 341.)

superimposed stones may give but one shadow. In this opinion we are in complete accord, as it has been a not infrequent experience in this series of cases (Figs. 341, 343, 345, 348). The importance of appreciating this possibility cannot be over emphasized not only during the operation, but during convalescence and subsequently. It has an important bearing upon the question of recurrence, a subject with which we shall deal forthwith.

While our cystoscopic findings have not been adequately recorded, it was none the less found that pus was present in the urine of the affected side in 39 cases, while in 10 instances only red blood-cells were present at the time of the examination.

In this connection it is interesting to note that the phenol sulphonephthalein test of the urine from the stone-bearing kidney was extraordinarily low in many instances. It was less than 20 per cent. in 28 cases of which in 10 it was too low

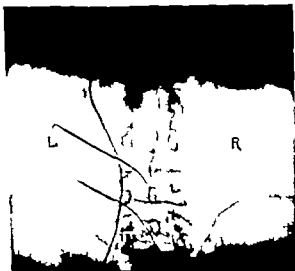


Fig. 343.—Same case as in Figs. 341-342, taken 1 year later. Patient sometimes passed two or three stones. One is now shown in the ureteropelvic junction evidently trying to escape. Since this plat was taken the stone has moved lower point opposite the dia. crest.

to be measured at all and was recorded as practically zero. In 4 cases of bilateral renal calculi the total renal function was 10 per cent. in 2, 20 per cent. in 1, and greater than this in another (Fig. 349). Furthermore it has been a not infrequent experience to find an alarmingly low test on the healthy side but in the belief that the activity of this kidney was embarrassed by disease in its mate we have not hesitated to operate. In almost every instance subsequent test of the bladder or

of the divided urines has shown a marked rise in the output of the drug.

It has already been shown that whereas the urine of the stone-bearing kidney is generally infected, it is also a fact that the urine is uninfected in a considerable number. This freedom from infection has been found not only in unilateral, but in bilateral kidney stones. This fact is sometimes a source of serious complications, and should be taken into consideration



Fig 344.—x Rays repeatedly negative for 15 years. Pus and blood from right kidney accompanied by frequent attacks of pain. Pyelogram not abnormal. A flat stone resembling large piece of clam shell was removed by pyelotomy. The stone proved to be composed entirely of uric acid. After removal it cast strong shadow under all conditions.

in a discussion of the case with the patient. It not infrequently happens that the necessary preoperative study of a case involving as it does the passage of ureteral catheters, may give rise to infection in one or both kidneys which did not already exist, or on the other hand, may bring about a sharp exacerbation of an infection already present. We have seen this occur not infrequently and although the consequences have never been fatal, the patient has often been made ill by the procedure

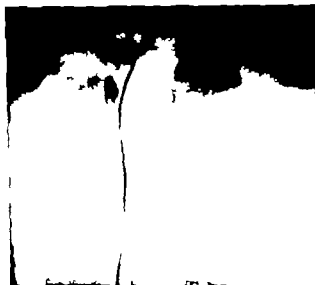


Fig. 345.—Shadow suggests one large stone. No others found at the time of pyelotomy. (See Fig. 346.)



Fig. 346.—Film taken during convalescence showing several small stones remaining after removal of one large stone by pyelotomy.



Fig 347—Pyelogram shows abnormal pelvis; plates of impacted kidney show what is apparently one large stone. (See Fig 348.)



Fig 348—Plate taken during convalescence showing shadows of several stones remaining after removal of one large stone by pyelotomy.

for a considerable period of time. It is particularly unfortunate and serious in the bilateral cases without previous infection

We do not believe that this complication can be avoided nor do we believe that one should desist from carrying out what is recognized as an essential preoperative study. Nevertheless the possibility of such a catastrophe should be borne in mind.

During the patient's stay in the hospital previous to operation and while he was being studied the only stone or one of many was spontaneously passed in twenty four instances. In view of this experience and where only a single small calculus can be demonstrated it seems not unwise to wait a reasonable



Fig. 249.—Unusually large branching bilateral calculi, resembling bilateral pyelograms. Patient in excellent condition, urine contained but little pus, pain an insignificant symptom. Renal function of 90 per cent.

length of time for its spontaneous passage this phenomenon being precipitated without question in many instances by the recumbent posture, free catharsis, large fluid intake and catheterization of the ureter which proper preliminary study involves.

If such a calculus does not pass spontaneously and if the patient lulled into a sense of false security by the subsidence of hitherto frequent attacks of pain refuses operation he should at least be kept under constant observation. Only recently one of us (J. D. H.) has had to remove a completely destroyed

and badly infected kidney in which a small stone was located by another surgeon about a year previously. At that time the kidney was not in bad condition. Meantime and without the patient's knowledge, the stone passed down to the ureteral orifice where it became impacted (Fig. 350) giving rise to the pyonephrosis from which she was suffering at the time of operation. Frequent urinary examination and an



Fig. 350.—Stone impacted in lower end of right ureter: pyonephrosis, nephrectomy. A year previously this stone was detected in the kidney pelvis and passed down the ureter unobserved.

occasional x-ray would have detected the change in the position of the stone.

In this series the calculi were unilateral in 130 and bilateral in 9 cases, or 6.4 per cent. 18 of our patients were our own re-entries or had had operations elsewhere for renal or ureteral calculi. In 12 of these cases the stones were bilateral at one time or another involving the kidney alone in 11 and one kidney

and the opposite ureter in 1. The difficulties of a second or third operation on the kidney are well known and undoubtedly are a factor in the mortality statistics.

Pyelotomy alone was performed 64 times, and was combined with nephrotomy generally partial, in 13 others. There were 39 nephrectomies and 17 nephrotomies, of which 3 were bilateral. It is, therefore, apparent that pyelotomy has been the operation of choice, nephrotomy being reserved only for the cases of very large or of multiple calculi. It also follows on this same reasoning that stones of the latter type are far less common than the smaller single stones, an experience which coincides with that of other clinics. We have also found that whereas the shadow found in the roentgenogram often indicated but one stone, one or more additional calculi were found at operation (Figs. 341-343 345-348). Our experience is, therefore, similar to that of Brunsch who says (*Surgery Gynecology and Obstetrics*, 1917 xiv) "in many cases where multiple stones were found at operation only a single shadow was found in the x-ray."

A chemical examination of the stones removed was made in 47 cases, with the following results: Calcium oxalate 20, calcium phosphate 10, calcium oxalate and calcium phosphate 10, calcium and magnesium phosphate 3, calcium phosphate with urates and calcium carbonate with calcium and magnesium phosphates each 2. It is obvious that calcium forms the basis of most calculi. It is equally obvious that stones composed of urates and uric acid, and more particularly cystin, all of which are apt to give negative x-ray results, are not of common occurrence.

There were various postoperative complications, some of considerable moment, others less severe, some were unavoidable, others might be ascribed to faulty technique or judgment. In 2 cases nephrectomy had to be performed shortly after the first operation on account of the persistence or aggravation of previously existing infection. 7 had a urinary fistula of long duration. 3 developed pneumonia. 4 had severe hemorrhage, of which 3 followed nephrotomy and 1 was subsequent to a pyelotomy. There was also one instance of each of the follow

ing complications: fecal fistula, ureteral obstruction, hematuria, hemorrhage during operation, shock and uremia. While there were numerous instances of wound infection, none of these were severe or generalized.

In spite of the fact that these cases were all of the usual hospital class and that they were operated upon by different members of the staff of 5 surgeons, our general mortality has been 3.5 per cent., comprising 5 cases. There were 2 deaths from pneumonia, of which 1 was uremic and practically moribund at the time of operation, this being done only in a desperate

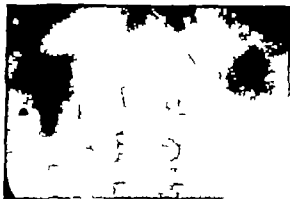


Fig. 351. Recurrent bilateral, multiple colitis in horseshoe kidney. Operation, August, 1915; right pyelotomy and nephrotomy. October 1915; left pyelotomy and nephrotomy.

effort to save life. One died of uremia, and here also it was a matter of trying to save the life of a moribund individual. Gas and oxygen anesthesia was responsible for the death of another—a probably unwise choice of anesthetic. Severe hemorrhage after nephrotomy was the cause of death in 1 case.

Operation revealed abnormalities of the kidney in 5 cases, consisting of horseshoe kidney in 3 (of which there were stones in both pelves in one patient, Fig. 351) and an aberrant renal artery over which the ureter was kinked in 2. None of these abnormalities were discovered before operation and are recorded

not only for their intrinsic interest but also to remind the reader that one must always be prepared for some abnormality when doing kidney surgery. The great majority of our cases left the hospital between two and three weeks after operation a few went home before the fourteenth day with the wound entirely healed but a still greater number stayed a much longer time owing to one complication or another.

It has already been shown that there are various opportunities for error in the diagnosis of renal calculus, not only as regards its presence but also in respect to the number of stones. To know that there is at least one stone in a kidney is valuable information but to suspect that a stone is present and be unable to find it at operation puts one in an awkward position. One constantly asks himself whether he has missed the stone in his search through the kidney or whether it was there at all.

The number of patients undergoing operation in whom subsequent examination shows the presence of one or more stones is appalling. While there is no question in our minds that the persistence of the condition in a kidney which produced the first stone may be and often is responsible for the formation of other stones constituting therefore, an actual recurrence, we believe that the operation does not remove all of the stones in a great many instances.

Among over 200 cases of renal stone in the hospital records we have found that an x-ray examination of the urinary tract during convalescence had been made in but 20 instances. In 9 or 45 per cent. of these there were shadows in the kidney operated upon which were undoubtedly those of stone. In 11 cases the roentgenogram was negative. This is a sad record of which we are not proud but we believe the facts should be made known. Furthermore we believe that the records of many other clinics both as to the number of postoperative x-rays taken and the number of stones left in the kidney will be found to be equally faulty. In short, we have reason to believe that the matter has not received the attention it deserves and that an effort should be made to improve the situation.

It seems to us that one of the first and most important steps in advance is to insist upon a roentgenogram of the urinary tract during convalescence in every case. This measure will not only show whether the operation has been efficient, but it will also furnish reliable data on the question of recurrence. In certain cases with a negative x-ray during convalescence the speedy return of symptoms together with a positive roentgenogram raises the question whether one is dealing with a true recurrence or an overlooked stone. But from the patient's viewpoint the net result is the same, and three possibilities are open to him namely a second operation, spontaneous passage of the stone or the *laissez faire* policy with its doubtful results. What, then, can be done to improve the situation?

In the first place, we believe it to be absolutely essential to establish a preoperative diagnosis which is complete in every particular. It should determine whether or no infection is present and the type of organism the function of both the affected kidney and its mate should be accurately estimated properly executed and interpreted roentgenograms should be obtained, as by this means valuable information is furnished not only as to the presence of stone but also as to their size, number and shape, factors which will help to decide the type of operation to be employed. It may also be said that if one set of plates is negative a second or third set may give positive results.

A pyelogram, with an opaque catheter *in situ*, will, if carefully executed, reveal abnormalities in the size, shape, and position of the renal pelvis and of its calices, and will also give still more accurate information as to the location of the stone.

Second, the operation best suited to the case should be most carefully considered. In some instances regardless of the size or number of stones in the kidney the thick, foul urine low function, pelvic dilatation or deformity pyrexia, pain, tenderness, and increased size of the organ will make it obvious that nephrectomy is necessary. There are other cases, however where with less destruction of the organ one will be tempted to save the kidney. Under these circumstances one will do

well to remember the statement of W J Mayo (Surgery Gynecology and Obstetrics, 1917 xxiv) that "one of the most common causes of recurrence of stone has been attempts to conserve a badly damaged kidney which was of little use functionally and a continuous menace to the patient."

On the other hand, the situation most commonly seen is that of a clean or mildly infected kidney with a good function and obviously worth saving. These cases again are subdivided into those with a small stone lying in the pelvis or calyx and easily capable of being extracted through a pyelotomy incision, and those with larger or multiple stones the extraction of which through the renal pelvis is doubtful or at least very difficult.

We believe there is no doubt that pyelotomy is the operation of choice. The dangers of a persistent urinary fistula can be disregarded and the mortality as reported by various observers, and in our own experience, has been exceedingly small. Brausch reports 206 cases from the Mayo Clinic without a death. In our clinic, over a period of ten years, there have been but 2 deaths. The success of this operation from the point of view of the presence of subsequent stone whether recurrent or overlooked at the time of operation, is, however not so brilliant, but, as we shall show offers as great a chance of success as the more serious operation of nephrotomy. Cabot and Crabtree (Surgery Gynecology and Obstetrics August, 1915) have shown that in 51 per cent. of cases undergoing pyelotomy at the Massachusetts General Hospital stones were found to be present in the kidney at a subsequent time. While there is no question that some (possibly most) of these stones were actual recurrences, we believe that it is equally certain that many were stones which had been overlooked at the time of operation.

This question cannot be definitely settled, however as few if any of these cases had had an x ray during convalescence. If therefore dependable end-results are to be obtained, all possible sources of error should be eliminated, and in this instance the omission of such an examination immediately gives rise to the possibility of faulty premises. We regret that the litera-

ture does not give more information as to the ultimate results of the work of other clinics in the matter of renal calculus. Braasch has reported recurrences in 14.7 per cent. of 88 patients after operation for renal stone, but does not make it clear what particular operation is involved in these figures, nor is it clear that he or some equally competent observer re-examined the cases. The work of Cabot and Crabtree is unique and valuable, in that the figures are based only upon the examinations made personally by the two men. With rare exceptions the results obtained by letter or by the statement of the family physician were not considered satisfactory. One will understand the reason if he recalls that in many instances of renal stone there may be no pain and the urine may be negative.

In the series of 139 cases now under consideration, of which many were among those already examined by Cabot and Crabtree, stones were again found in the kidney after pyelotomy in 32.8 per cent. While we would like to regard these stones as "recurrences," we do not feel that this would exactly fit the case.

Under certain conditions it may be impossible to be sure of removing some stones. Where one is dealing with a small calculus in a calyx with a stenosed orifice it may be impossible to locate this orifice at all, or only after protracted search. Long-continued exploration, no matter how blunt the instrument or how delicate the touch, will generally produce considerable hemorrhage from the pelvic mucosa. The blood may clot around the stone and cover it with so dense a layer of fibrin that it no longer grates on a metal instrument, and even when of considerable size it may readily escape detection. Even when removed the stone may not be felt with the fingers until the heavy coat of fibrin is peeled off. We feel certain that this is an important factor in the so-called recurrent cases. It is also undoubtedly true that where the roentgenogram has shown what seemed to be but one stone the failure to find and sometimes even to search for others has been responsible for the subsequent results. In few of the "recurrences" reported by Cabot and Crabtree and in the light of our own personal

experiences with such cases, we venture to state that there are certain instances in which it is not humanly possible to recover every stone by the operation of pyelotomy unless one calls to his aid some other method of search than the finger and the probe. We believe that the fluoroscope used in conjunction with the operation by a trained observer furnishes us the means of locating many stones which would otherwise be missed. It has been used with success in certain clinics in this country and we believe that the time will come, if indeed, it is not already here when the fluoroscope will be regarded as essential to the proper performance of pyelotomy or nephrotomy. The technic has been so well described by Braasch and Carman (*Mayo Clinics* 1919 xi) that it is needless to go into it here but we feel that a note of warning should be sounded as to its promiscuous use. While the small portable army machine is very satisfactory there is a very real danger of an explosion of ether vapor from the sparks of the unprotected tube and wiring. Although there seems to be no allusion to this danger in the literature, we have personal knowledge of its occurrence in more than one hospital.

There is now on the market an excellent apparatus well adapted for this purpose and so protected by oil that the danger of sparking is entirely eliminated. With this apparatus one can safely use ether but in view of the possible danger of the use of this anesthetic with the army machine gas-oxygen anesthesia only should be employed. The ordinary army apparatus can however be made safe by housing its tube and wires in a simple wooden cabinet. Some arrangement must be made for turning the tube in any direction and for changing its height, but the work can be done by good carpenter under the direction of the roentgenologist.

Let it be thought that the chances of overlooking stones are entirely eliminated by the use of this apparatus in conjunction with the operation we will briefly recite a recent experience. The patient was a girl of eleven years in whom the x-ray showed several small shadows in the left kidney (Fig. 352). The kidney was found to be rather dilated. Two or three

small stones were removed through a pyelotomy incision. The fluoroscope was then used, and with its aid one or two more stones were found and extracted. Without this apparatus we feel sure that these particular stones could not have been located or removed except by accident, as they were very small and so covered with fibrin that they produced no grating sensation against a metal instrument and felt and looked like blood-clots. Having removed all the calculi which had been located, another fluoroscopic examination of the organ was made but no other shadows were to be seen. During convalescence an



Fig. 352.—Small multiple stones scattered through the kidney pelvis and calices. (See Fig. 353.)

x-ray examination showed two shadows, probably those of calculi still remaining in the kidney (Fig. 353). While this was an unusually difficult case, owing to the small size and multiplicity of the calculi and to their wide distribution, it shows not only that the fluoroscope was a most invaluable aid but also that even with its use it may be impossible to find all calculi.

Before taking up certain other phases of the problem of renal calculi we wish to state that our experience has not been happy in the removal of large stones through the renal pelvis by first crushing them within the kidney a procedure which

has been advocated and practised by some. A young woman, epileptic and frail, was admitted to our service with a large renal stone. The kidney was not badly damaged and nephrectomy was not to be considered. One of us (J D B) having only a day or two previously performed a secondary nephrectomy for hemorrhage on a patient of a colleague who had done a



Fig. 353.—Pyelotomy and partial nephrotomy was performed in conjunction with the fluoroscope. Several stones were located by this apparatus which would not otherwise have been found, as they are covered with heavy coat of fibrin. Careful examination of the kidney finally showed no stones remaining in the kidney. This plate, taken during convalescence shows one or two shadows which are undoubtedly small stones.

nephrotomy for stone a week previously the idea of a possible repetition of this experience in this young woman did not appeal strongly. The stone was too large to extract through a pyelotomy incision (Fig 354). It was therefore cracked into fragments with a heavy clamp inserted through the pelvic incision. All the fragments were apparently removed and careful search showed no evidence of others. An x ray taken a week later

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tion was advised and accepted. At this time two or three fragments corresponding to those shown in the x-ray were removed, and every effort was made to have the kidney free of all stones. During the convalescence from the second operation a roentgenogram was taken and to our surprise and chagrin, a small stone was found to be still remaining in the kidney (Fig. 356). In view of the small size of the stone and the possibility of its subsequent spontaneous passage further interference was considered inadvisable. While we are not proud of this



Fig. 356—Showing one fragment of stone remaining after second operation (Fig. 355). Subsequent high time careful search showed no evidence of stone.

experience, we regard it as a valuable one. It is often impossible to extract even a small stone without breaking it accidentally and under these conditions the removal of all the fragments is a matter of great uncertainty. To deliberately break up a stone seems to us unwise, even though such a procedure may at first appear to offer a simple solution of the problem.

Another point which we wish to dwell upon for a moment is the not infrequent coincidence of renal tuberculosis and stone. Tuberculosis of the kidney is often accompanied by more or



Fig 354.—Large stone in renal pelvis impossible to remove by pyelotomy. Stone cracked into several fragments with heavy clamp and extracted piece-meal. Fragments apparently entirely removed.



Fig 355.—Showing fragments still left in kidney (Fig 354) after cracking large stone and extracting fragments through pyelotomy incision.

(Fig 355) showed at least two fragments still remaining. The situation was fully explained to the patient, and a second opera-

as the pathologist reported tuberculosis, involving chiefly the calyx in which the stone was located.

We feel that this experience is of value as where the x ray indicates a renal calculus it is apparently possible at times to find a coincidental tuberculosis of the kidney a condition for which nephrectomy should be performed as a primary and not a secondary measure.

If then, pyelotomy with or without fluoroscopy so often fails in its purpose, it might be supposed that nephrotomy



Fig. 358.—Same as Fig. 457 (for nephrectomy for tuberculosis). Pyelogram showing stone in lower calyx of kidney. Successful removal by pyelotomy.

an operation by which the interior of the kidney may be inspected and palpated would accomplish the desired results. A review of the situation does not, however show this to be the case. In the article by Cabot and Crabtree already referred to the end results of 30 cases of nephrotomy were obtained by personal examination of the patient, including x-ray and urinalysis. 56 per cent of these cases showed stone in one or both kidneys at this examination, a somewhat higher percentage than that found after pyelotomy. In the present series the percentage of stones after nephrotomy was 30.3 per cent., a figure which

less calcification of the organ actual stone formation is not so common. We have, however, been fortunate enough to see several examples. One of us (J D B) has recently reported such a case (Trans. Amer. Assoc. Gen. Urin. Surgeons, xiii, 1920) complicated by inguinal renal fistula and transverse myelitis, and has had 2 others in his own practice. Figure 357 shows bilateral renal calculi with tuberculosis of one kidney (catheter *in situ*). In Fig 358 taken after nephrectomy a pyelogram was taken of the opposite kidney and the stone



Fig 357—Renal tuberculosis with calculus on one side (catheter *in situ*) renal calculus on the other

is clearly shown in one of the lower calices. This stone was successfully removed by pyelotomy.

Another such case is shown in Fig 359. The small calculus was situated in the upper calyx of the kidney and produced no renal symptoms whatever. The urine from this kidney contained but little pus, and tubercle bacilli were never demonstrated either by microscopic or guinea-pig test. Owing to the extremely bad condition of the patient's heart it was thought best to end all possibility of further operation on this kidney by removing it. This proved to be a fortunate step.

operation is of comparatively recent date, as we are told by Watson (Watson and Cunningham *Genito-urinary Diseases*, ii) that one of the earliest, if not the earliest, operation of this nature was performed by the late Dr William Ingals at the Boston City Hospital on October 8 1872 Newman (*Lectures on the Surgical Diseases of the Kidney* 1888) refers to an operation for the removal of stone done by Durham in 1872. Sir Henry Morris (*Surgical Diseases of the Kidney and Ureter*) performed this operation in 1880 and claimed that it was the



Fig 360.—Pyelogram of kidney shown in Fig 359. Upper calyx has ragged appearance and its extremely long and narrow outlet is of interest.

first of its kind ever performed. Be that as it may nephrotomy proved from the first to be a dangerous and difficult procedure.

Watson (*loc cit*) collected from the literature 309 cases, with 29 deaths a mortality of 9.3 per cent. Where the kidneys were infected the mortality among 87 cases was 18.3 per cent., while where they were "uninfected" there was a death-rate of 2.2 per cent. among 135 cases. It must be remembered however that these cases were culled from the literature of an earlier day when the question of renal infection was less understood than at present.

A recent report of Braasch (*Surgery Gynecology and*

might be higher were we to have gone into the end-results *intensively*. The cases on which we base this statement, as well as that of the results of pyelotomy were either re-entries in our service, coming in for a second operation, those admitted for the first time after having had a previous operation elsewhere, those coming to the out-patient clinic as our own re-entries, or as new cases.

The success of nephrotomy therefore, cannot be said to be brilliant. The probable explanation of the high percentage of recurrence is that the primary condition for which the opera-



Fig. 159.—Renal tuberculosis with stone in the upper calyx of the left kidney, guinea-pig negative on two occasions, tubercle bacilli never found.

tion was done was one of large or multiple stones, and the still unknown circumstances producing such stones was not altered by operation. Granting this premise we are dealing with actual recurrences. On the other hand, the arrangement of the calices may be such that even with kidney fully opened one or more of these stone-bearing cavities might be easily overlooked, in which case the term 'recurrent stone' would not be applicable.

Nephrotomy therefore, has real drawbacks, the least of which is the possibility of recurrence of the calculus. The

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Fig. 160.—Pyelogram of kidney shown in Fig. 159. Upper calyx has ragged appearance and its extremely long and narrow outlet is of interest.

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A recent report of Brunsch (*Surgery Gynecology and*

Obstetrics, 1917 xxiv) of the operations for renal stone at the Mayo Clinic shows no mortality among 40 nephrotomies. We regard this statement as significant. It shows in the first place how comparatively infrequent an operation nephrotomy is in the work of skilled operators for in 484 operations for renal calculus there were 206 pyelotomies, 188 nephrectomies, 16 nephro-ureterectomies, 40 nephrotomies, and 34 operations in which pyelotomy was combined with nephrotomy. It is obvious that in most cases where pyelotomy will not suffice either for the removal of the stone or for proper drainage of the kidney the removal of this organ is deemed the wiser procedure. While there has been no mortality from nephrotomy the convalescence has apparently not always gone smoothly as W J Mayo (Surgery Gynecology and Obstetrics, 1917 xxiv) states that "several had hemorrhages after operation, and in 4 it was necessary to do a nephrectomy to save their lives. Bevan (Surgical Clinics, Chicago II, 1918) has had a similar experience, and has had to do a secondary nephrectomy in 8 or 10 cases within one or two weeks after nephrotomy.

After reading these reports we feel that a statement of our experience with nephrotomy at the Massachusetts General Hospital will be of interest. There have been 70 cases from 1897 to date. The operative mortality has been 5.7 per cent. comprising 4 cases, of which 2 died as a result of secondary nephrectomy for hemorrhage, and 1 died of streptococcus septicemia. In the fourth case the record failed to state the cause of death. There were 11 secondary hemorrhages (15.7 per cent.), of which 3 required nephrectomy. In 7 the bleeding ceased spontaneously and the patient recovered. In 1 case the wound was successfully packed. The ages of the patients ranged from eleven to sixty-four years.

In 28 or 40 per cent. multiple stones were found. In 33 or 47.1 per cent. a single calculus was removed. In 10 no stone was found, but these cases occurred mostly in the early days when the x ray and cystoscope were less frequently employed. In 3 cases there was a simultaneous bilateral nephrotomy. In another the second kidney was nephrotomized after

an interval of a few days. The "recurrence" in this set of 70 nephrotomies runs as high as 52.9 per cent. a figure which compares closely with that of Cabot and Crabtree and which should leave no doubt in anyone's mind that the operation is not always productive of success. Furthermore, when one considers how frequent is the occurrence of secondary hemorrhage, and how often nephrectomy must be done to save life, he should consider well all the other possibilities before undertaking this operation. This is especially the case in view of the high percentage of recurrence shown to occur after the patient has been fortunate enough to escape the dangers already enumerated.

In 11 of our cases (15.7 per cent.) convalescence was interrupted by postoperative hemorrhage. In 3 this bleeding was so severe that nephrectomy had to be done on the eighth, nineteenth and twenty first days respectively indicating that hemorrhage which is severe at its onset, or which becomes so by its continuation, does not always tread on the heels of the operation. One patient bled quite steadily for eighteen days, at which time the kidney was packed with gauze and recovery took place. The remaining 7 had more or less bleeding either through the wound or through the urethra, but in all it ceased spontaneously under careful and well judged observation. It may be remarked here that the question of whether or not to interfere in the presence of hemorrhage calls for the best surgical skill. In cases of massive hemorrhage with all the well-known symptoms there can be no doubt of the necessity. In other instances where the bleeding is less severe the situation demands the most expert judgment. One hesitates to pack a kidney or to take it out unless it is absolutely necessary on the other hand he who waits till the last moment finds himself operating in frantic haste on a patient who is not only exsanguinated, but who has also hardly recovered from the effects of a long and bloody operation only a few days before. The results of such delays are often fatal.

In 21 of our nephrotomies (30 per cent.) the kidney was simply packed with gauze at the time of operation. In 4 there

was postoperative hemorrhage requiring nephrectomy in one instance additional packing in another. In 36 cases (52 per cent.) the kidney was closed by suture generally with a flat piece of gutta-percha drain down to the pelvis. Six of these cases developed a postoperative hemorrhage requiring nephrectomy on the nineteenth day after operation in one instance. In the remaining cases (18 per cent.) the kidney was sutured around a rubber tube placed in the pelvic cavity and post operative hemorrhage occurred in but one of these. It appears, therefore, that the manner of handling the kidney after nephrotomy has little or no influence upon the incidence of subsequent hemorrhage although those in which a rubber tube was used seemed to have fared better. The general opinion among surgeons seems to be that the kidney should be sutured rather than packed, but one must always bear in mind the possibility of destroying additional renal tissue by tying the sutures too tightly or by so placing them that they will cut off the blood-supply from large areas.

In the more recent cases we have resorted to the method of splitting the kidney from within outward by means of silver wire threaded either on a curved liver needle or better on blunt, flexible probe. The cases in which this method has been used in preference to the old method of dividing the kidney from without inward by means of knife are too few to enable us to express any final opinion as to its possible advantages. Experimentally it seems to have reduced the likelihood of hemorrhage both during operation and subsequently.

A survey of the possibilities offered by nephrotomy are not brilliant. The higher mortality the likelihood of postoperative hemorrhage with its serious accompaniments, and the undoubtedly great number of stones found later either as left-overs or as actual recurrences, should make one hesitate to select nephrotomy as the operation of choice.

Lest the surgeon, having in mind the somewhat disheartening data presented, might hesitate to advise or perform operation for the removal of renal calculi, we wish to state emphatically that such a course will almost inevitably be a source of regret

to the patient if not to the surgeon. In spite of the high percentage of "recurrences" here reported the patient should not be encouraged to carry about with him until necessity forces the issue a stone which is surely but insidiously doing serious damage to his kidney. In most instances a pyelotomy will suffice to remove the stone and we have pointed out the small risk attending this procedure. Even though nephrotomy is deemed necessary the mortality is not terrifying nor should the chance of secondary hemorrhage act as a deterrent. In other words, it is safer in the long run to remove a stone than to allow it to remain in the kidney.

In closing we wish to make a plea for the more intensive study not only of the diagnosis of renal stone but also of the operative technic. The matter of end-results is a question of universal interest and one which has not received its due share of attention. The acquisition of reliable data is possible only if satisfactory roentgenograms are taken after as well as before operation. In view of the importance or rather the necessity of personal examination of the patient and of good radiographs, the collection of reliable and large statistics of end results is difficult but not impossible. We believe that such data will be more encouraging than those already collected if some of the pitfalls already enumerated are borne in mind and if the fluoroscope is used in conjunction with the operation.

CLINIC OF DR. JOSHUA C HUBBARD

BOSTON CITY HOSPITAL

RECTOVAGINAL FISTULA

THE method which I shall describe of dealing with a recto-vaginal fistula is so simple in technic and so satisfactory in result that I am sure it must be in use by many surgeons, even though no



Fig. 361 —The skin incision.

mention of it can be found in recent books on surgery or gynecology. Where reference is made to an operation perhaps somewhat similar not enough details are given to make the various steps clear and often some of the essentials are omitted

If the operation is an old one which has been forgotten, it is time now to call attention afresh to its good features.

The condition *causing a rectovaginal fistula* almost necessarily leaves a woman with a badly torn perineum. This operation is planned not only to cure the fistula, but to repair the perineum.

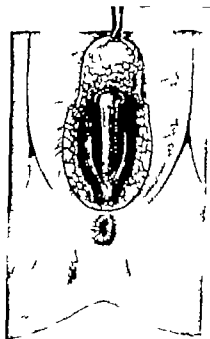


Fig. 362.—The dissection of the fistulous tract

The various steps of the operation are made clear in the accompanying drawings.

A curving incision is made at the line of junction of the mucous membrane of the vagina and the skin. It begins high on one side and swings down and up to corresponding point on the opposite side (Fig. 361). A flap of mucous membrane is turned up from the floor of the vagina till the fistulous tract

made evident by a probe passed through it is reached. This is dissected out intact (Fig 362). An incision about the vaginal opening is made. A hemostatic forceps is passed through the fistula from the rectum, fastened to the vaginal end, then pulled back through the rectum turning the fistula inside out (Fig 363). Should the fistulous tract be too small to admit even a mosquito

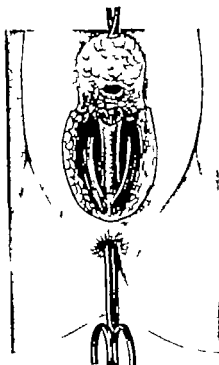


Fig 363 —The beginning of the inversion of the fistulous tract.

hemostatic forceps it might be possible to accomplish the inversion by a suture fastened at the vaginal end of the tract carried down through the fistula and out the rectum. A pull on this would invert the tract unless its lumen were too small to accommodate the thickness of its wall. By putting some tension on the fistulous tract thus turned inside out the sides of the fistula, where it passes through the rectal wall are brought to-

gether The opening in the rectum is then closed on the perineal side by catgut sutures which may be placed so that the knot is in the rectum or not, as one pleases (Fig 364) The excess of tissue containing the fistula is cut away the opening in the vaginal mucous membrane is closed. The perineum is then repaired by pulling the muscles on either side of the denuded area together by buried catgut sutures (Fig 365)

This operation is naturally most easily done when the fistula is situated low down, but is applicable to one higher up the

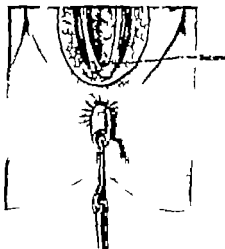


Fig. 364.—Fistulous tract completely inverted The opening of the rectal wall sutured

limit being only determined by the accessibility It has the distinct advantage of entire removal of the fistulous tract and separation of the suture line in the rectum from that in the vagina, by considerable distance, by the aid of the plastic which places the thick bellies of the perineal muscles between the two suture lines, thus materially decreasing the chance of recurrence.

This short paper is intended to serve as a reminder of an old, perhaps forgotten, technique which may help to cure some of these at times difficult cases.

David (Surgical Clinics of Chicago) mentions an operation apparently very similar. The technic of the different steps is not clearly given, and no mention of any plastic on the perineum is made—a serious omission.

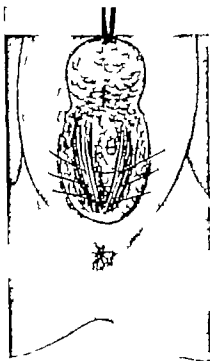


Fig. 365.—Opening in rectal wall and vaginal wall closed. Sutures placed in the muscles of the perineum.

After this paper had been promised and finished for the Surgical Clinics of North America, an article on Perineorrhaphy for Complete Laceration by Watkins appeared in *Surgery Gynecology and Obstetrics* for April 1921 describing and illustrating a technic very similar to the one described above.

CLINIC OF DR. FREDERIC J COTTON

CHIEF CONSULTANT IN SURGERY U S PUBLIC HEALTH SERVICE,
PARKER HILL HOSPITAL, BOSTON

A "RECONSTRUCTION" CLINIC

THE cases here reported are those shown to the Boston Surgical Society March 7 1921 at the Parker Hill Hospital of the United States Public Health Service successor to United States Army General Hospital No 10 by my colleagues and myself.

In the main they represent work of the type we have come to call 'reconstruction' work.

They represent a list of 50 of the interesting cases of the year past, sent out for to report on the given date, sent for 'sight unseen,' cases shown as they came—good and poor results together as chanced.

It is time that more attention be paid to reconstructive surgery involving as it does (1) more than the usual care as to the picking of cases, with ruthless rejection of some and postponement of those cases in which early operation means undue risk (2) refinement of procedure, of local preparation, and of operative technic, so as to avoid the disasters that have marred the record of such work in the past (and even during the war years) (3) careful fitting of the operative plan to the *functional* result that one desires to reach (4) meticulous care in convalescence (5) after-care under the best of physiotherapy carefully checked up by the best *surgical* supervision.

It is not pretended that the cases here presented measure up to this standard but it is true that they were cared for under conditions of proper equipment and picked and experienced personnel and *continuous* personal supervision throughout, conditions much more favorable than in most public hospitals.

The results are no better surely than we ought to get any where given these favorable conditions.

The material certainly is not favorable, consisting of men in early adult life, to be sure, in most cases but, on the other hand representing not the successes, but the "culs" and failures of a long succession of army hospitals.

Case L.—Operation before the clinic, ——— age twenty-two years.

History of years of trouble with the left knee, with occasional locking and subsequent synovitis of a few days. Never any locking of considerable duration. Tenderness (and point of apparent obstruction) to the outer side. On examination showed nothing objective save slightest blurring of bone outlines and a little laxness of capsule and a little atrophy of quadriceps muscle. Slight abnormal mobility of tibia on femur forward. x Ray showed a small bone nodule in middle of joint. Operated on because of the intermittent crippling from displacement of the external cartilage, not for the laxity of the joint.

Operation, 3/7/1921 Cotton operating Cotting and Dunphy assistants. Ether anesthesia.

Long sweeping incision carried $1\frac{1}{2}$ inches to inside of middle of patella. Skin and superficial fascia dissected back. Knee flexed, knife cut to patella midline. Saw cut in vertical line about $\frac{1}{2}$ inch in. Patella then split with chisel placed in the long axis of the patella (not cutting toward the femur) and opened up. Cut from ends of this fracture line through the tendon up to the top of the quadriceps pouch and down to the tibial tubercle, including the midline fat pad and the ligamentum mucosum. Joint then opened up and flexed. The bone node proved to be in the anterior crucial ligament, from which it was shelled out. One catgut stitch in the slightly lax ligament. This node entirely *within* the ligament—apparently grew there. External meniscular cartilage loose and showing the thinned-out scars of many pinchings. The back half was displaced forward and lay in front of the femoral condyle, folded almost in contact with the front half. Whole cartilage removed.

The outer ligamentum alarium showed hypertrophy and distinct scarring and thickening from being punched. This, the corresponding inner fringe, and much of the fat pad below the ligamentum patellæ removed, and the gap in the synovia brought together with catgut sutures in the fat, not penetrating the joint. Joint washed out with salt solution. Knee then straightened and the joint closed—not too tight—with a few gut sutures in the tendon, not going through to the joint surface, and close suturing with kangaroo tendon of the periosteal fascial layer across the gap in the patella. Loose skin sutures of silkworm-gut. Dressing ham splint no plaster.

(Later motion begun at two weeks. Splint off at three weeks. This case happened to show almost no effusion or other reaction.)

Old Cases Knees.—*Case II*—W W D Age thirty-six. Machinist. Diagnosis Loose bodies, left knee-joint.

On February 2 1920 patient twisted his left knee while at work in navy yard. Injury did not seem severe but began to trouble him in a few weeks and since then has intermittently laid him off from work.

Admitted to this hospital March 5 1920 Examination revealed movable body felt in left knee at inner aspect of patella. Painful to pressure motion not limited. Decision made to do radical operation because of osteochondritic changes obvious in the x ray as well as because of the loose body.

March 10 1920 Ether and "Corner" operation. F J Cotton. Median arthrotomy Removal of three loose bodies with excision of redundant fat pad osteochondritis desiccans changes, mild grade Knee put in plaster Cast removed March 24th, active motion started Uneventful recovery

Examination 3 7 21

Complaint None

Excellent result At work at former occupation at Charlestown Navy Yard Full range of motion.

Case III—J C Age twenty-six. Salesman. Diagnosis Dislocation internal semilunar cartilage, left knee.

In October 1918 patient fell on left knee while running

Limb was injured to such an extent that he had to be assisted to his bed. He reported sick call the next day and was laid up for six weeks. Patient has never been able to do a full day's work since the accident, and gives history of locking at various intervals. Patient was admitted August 17 1920.

Examination reveals slight swelling of left knee, with considerable thickening of knee-joint. Knee can be flexed completely but extension is limited about 10 degrees. Has definite point of tenderness over internal cartilage.

August 28, 1920 Ether and operation. F J Cotton. Usual lateral incision was made over left knee joint. Joint opened and internal cartilage, anterior end found torn loose and dislocated backward. This cartilage was removed in the usual manner. No arthritic changes noted. Knee-joint closed and posterior splint applied.

Wound healed and gentle motions started in ten days. Patient allowed up on crutches in thirteen days. Manipulations daily. Physiotherapy started.

Examination 3/7/21

Complaint None

Full range of motion no limp good result.

Case IV—G. A. Age thirty-two. Married. Admitted May 21 1920

Began to have trouble with knee in army about September 1918, without any single trauma. Since then has been able to work for a while but at intervals knee swells and becomes sore and useless. Shows nothing on examination except swollen knee with capsular thickening of the villous arthritis type.

Operation May 22, 1920 Cotton. Longitudinal "Corner incision. Marked villus proliferation. Cartilages loose, both cartilages and a large amount of villous growth removed, including the ligamenta alaria on both sides. Splint worn until June 6th. After this time active use with massage. Discharged first of July. Re-examined March 7 1921. Shows knee substantially normal, though bony outline not as sharp as on the other side. Says he has occasional discomfort in it, but nothing to interfere with the use of it to any extent.

Case I—J G—Referred by Dr C F Painter of the Naval Hospital, for semilunar cartilage Typical history of recurring luxation of internal semilunar with fleeting synovitis following each "jamming"

Operation, 1920 Typical oblique incision on the inner side, with removal of the internal meniscus torn across not far from the front end. Front end of cartilage removed and the back end as far as scissors would reach. Nothing else found.

March 7 1921 Practically perfect result. Full motion. No disability though joint not quite as strong as normal.

Case VI—N R. Age twenty nine First seen by me in spring of 1919 with occasionally recurring synovitis of left knee originally following slight trauma. Each attack with pain, local heat, some fluid Physiotherapy etc. tried out. Tonsils removed in December 1919 He wearied of all this and finally prevailed on me to operate

February 1920 operation Long "Corner" incision, and to my surprise very definite scars from pinching of the internal ligamentum alarum Both ligamenta alaria and the internal meniscus removed.

Usual routine, with motion after two weeks.

Recovery a bit slow even under baths and massage and exercises, but March 7 1921 shows a knee slightly thickened as to capsule, with occasional sensitiveness and heat, but substantially normal.

Case VII—L A C Age twenty four Inspector of Ordnance Diagnosis Old fracture of medial condyle of left femur

Patient fell on timbers at Fort Strong July 1 1918 Was in hospital about three months, and has not been able to do full duty since.

Admitted to this hospital January 15 1920. Examination of left knee shows limitation of extension of about 30 degrees, sharp bony limitation, and some backward luxation of leg Crepitus is felt and heard over the internal side of the joint. x Ray shows old fracture of condyles, with the back part dis-

placed back and up with the tibia leaving a shelf in front, against which the tibia "chocks up" in attempted extension (Fig. 366)

January 30 1920 Ether and operation. F J Cotton. Knee-joint opened. "Corner" technic, rather extensive bone plastic in remodeling of deformed condyles performed. Cast applied. Considerable reactive synovitis (Fig. 367)



Fig. 366.—Case VII. Ra. showing old fracture and absolute check on extension due to bony deformity within the joint

February 24 1920 Cast removed and physiotherapy started.
Examined March 7 1921

Complaint. Discomfort in cold weather. Walks with slight limp. Has practically full extension. Muscle development and power about normal.

Case VIII—D F S Age twenty-one Occupation long-shoemaker.

Diagnosis Ruptured crucial and internal lateral ligaments, left knee.

While playing football at Camp Devens, Massachusetts, in 1918 patient was thrown to the ground and left knee severely wrenched. Admitted to this hospital June 19 1920 complaining of weakness after walking short distances. Knee is unstable and patient cannot bear his weight for any length of time. Complains of some slipping and of noise. There is a rather appalling crunching noise on flexing the knee under weight—not on loose flexion. There is considerable anteroposterior



Fig. 367.—Case VII. Diagram of operation.



Fig. 368.—Case VIII. Diagram of operation. Artificial internal lateral from fascia lata, rove in under the cortical layer above and below; all outside the joint.

mobility moderate laxness laterally. No swelling. Synovitis occasional only. Recommended by me to hospital after some months of watching and various ineffective palliative treatments.

June 29 1920. Ether and operation. F. J. Cotton. Incision was made over the internal condyle of left femur extending down over internal tuberosity of tibia. Knee-joint opened and crucial ligaments found to be torn. Semilunar cartilages found to be hypermobile, internal one being removed and crucial ligaments trimmed. Incision made over outer surface of thigh and 8-inch strip of fascia lata removed about $\frac{1}{2}$ inch wide. From the posterior lateral surface of the internal con-

dyle this fascia lata strip was inserted through drill holes and lashed, stitched, and fixed. This was stretched down anteriorly where it was attached in similar manner to the anterior lateral surface of the tibial tuberosity forming an artificial internal lateral ligament stretched over the healed but lax original ligament (Fig. 368)

Patient was allowed up on crutches in August, and allowed gentle active motion assisted by physiotherapy. From this date on, motion gradually increased.

Examined 3/7/21

Complaint Tires on long exertion. Walks without limp. Very stable joint. Noise has disappeared. Reports having had a lot of slipping three or four times, only slight. Ligament palpable. Lateral motion none anteroposterior motion very little.

Case IV—W. M. S. Age forty-four Occupation taximeter
Diagnosis Crush of left knee, resulting in permanent flexion.

On June 26, 1917 while driving taximeter patient was thrown to the ground sustaining laceration of left knee. Was treated at Waltham City Hospital until November 26 1917 during which time sepsis developed, involving the tissues about the knee-joint. Patient received treatment at the Orthopedic Out-patient Department, M. G. H. On examination shows very extensive and deep scars of outer side and popliteal space with permanent knee flexion of 30 degrees joint free, but not over 10 degrees. Joint lame Tires easily Unable to work

In July 1918 the tendo chillo was cut to relieve dorsiflexion deformity

Admitted to this hospital January 12 1920

January 16, 1920 (under ether) Tenotomy of the hamstrings and stretching was performed. Leg put up in plaster which was worn until February 1920 Cast was removed and walking caliper splint with anterior knee pad applied.

March 9 1920 Only small amount of motion possible. Knee extends to an angle of 145 degrees. Physiotherapy treatment for about two months, with very little improvement. Patient unable to bear weight without the aid of the splint.

June 22 1920 Ether and operation Dr Cotton

A supracondylar osteotomy was performed on the anterior surface of the femur and leg put up in extended position in plaster

Recovery was uneventful, and in eight weeks firm union was obtained.

Examined 3/7/21

Complaint Limp Weakness. Toe-drop Has about 15+ degrees motion Partial toe-drop Toe-drop splint ordered.

There is a good deal of tenderness still, though the leg is solid and straight. The toe-drop discovered 3/7/21 developed since his discharge.

Review of Knee Cases—Noteworthy that, as I have long contended, the long incision advocated by Corner heals without more reaction than the peep-hole incisions, and as quickly and well, and enables us to get a decent view

For simple demonstrated cartilage cases—like Cases III and V—the little old fashioned incision is enough, and I still use it.

For any case not quite clear like Cases II or IV or VI or cases for extensive dissection, like Case VII there is nothing to my mind to excuse less than the radical opening up

It is rather astonishing how often one finds something in addition to the diagnosed lesion.

Case VII must be nearly unique the result a very satisfactory reward of radical handling

Case VIII is my way of handling the loose traumatic joints The first case, about seven years ago was moored with braided silk on both inner and outer side. The silk came out, as we later learned was the habit of silk so used but the joint stayed stable Since then I have always used fascia lata rope run through drill holes in under the cortical layer running a bit obliquely from just in front of the axis of rocking on the femur down and slightly back (this in case the femur goes forward, reverse if it tends to slip back) The new ligaments may be pulled very tight and laced and lashed with sutures. This

operation does not open the joint, though I deliberately opened it to explore in Case VIII.

In the half-dozen cases in which I have done this operation results have been very satisfactory with no lax joints after operation, and I regard this as the operation of choice in the type called ruptured crucials, in which the joint has loose motion laterally as well as anteroposteriorly.

A little study shows which lateral, internal or external, is lax.

Save in rare cases in which one can suture back a torn-off spine I can see no prospect of any stability in direct repair of crucials, or in any operation save the crossing in the notch of sutures or wires penetrating condyles and tibia in an X pattern, an operation discredited if silk or wire are used, untied, I think, with fascia.

But if the technic here detailed does the work, why rip things up so much for a doubtful advantage, to say nothing of the chance of trouble.

I present this technic as *the* way to deal with these lax joints.

Case IX is a failure.

Osteotomy was deliberately chosen instead of arthroplasty because of the chance of infection on the face of the very extensive and deep scarring all about the knee. It would evidently have been better to do an excision in slight flexion, the present disability being largely due to the remaining mobility small and worse than useless, as it proves, but even today I should hate to chance an excision with so little intact skin to cover up with.

Old Cases: Recurrent Shoulder Luxation.—These cases were all handled by the technic detailed by the late Herbert L. Burrell in an article published in *Trans. Amer. Surg. Assoc.*, 1897 p. 293. I have not done many of these, but have followed his technic not only as written, but as I had the good fortune to see him carry it out. The gist of the matter is a *sufficient* reefing of the capsule at the point where the subscapularis muscle merges with the capsule (the subscapularis "tendon") and below this point. Every case I have seen shows a marked slack of the front and lower capsule—enough to take a reef of $\frac{1}{2}$ to $\frac{3}{4}$ inch.

One must cut to get raw surfaces, though there is no need of opening the inner synovial capsule (It was not opened in any of the following cases) and then one may overlap or quilt up the raw cut tissue in a central ridge that is immaterial, so that one takes up the slack and takes it so that it will stay

The incision is Hueter's long anterior incision

Case Y—R. M. Age twenty-seven. Machinist.

Diagnosis Recurrent dislocation, left shoulder

While at bayonet practice September 1917 patient dislocated his left shoulder. Was discharged on account of this disability in December 1917. While at home dislocated the same shoulder four or five times. Was drafted again September 1918, and was put in general military service although he was unable to raise arm above level of shoulder.

Has dislocated left shoulder about fifteen times in all. Was discharged May 1919 for the same disability. Right shoulder was dislocated for the first time about six weeks ago while the doctor was reducing the left under ether. Right shoulder has been dislocated three times.

Two operations on the left shoulder in the army—failures.

Open operation at Boston City Hospital in 1918 on the left shoulder—failure.

Shows very poor musculature throughout but especially in shoulder and scapular region both sides. No diagnosis of progressive muscular atrophy can be established. Left shoulder all shot up with operative scars front and back. Some stiffness in abduction.

Admitted to this hospital April 12 1920. April 16 1920 Ether operation. F. J. Cotton. Through an anterior incision. Burrell operation was performed on the left shoulder for recurrent dislocation. Patient made uneventful recovery. Discharged May 5 1920 with advice that if dislocation continues in the right shoulder operation would be considered.

Examined March 7 1921. Complaint None. Function fair musculature better motion improved. No dislocation since. Right shoulder has not been out either.

Case V. J. O. G. Age twenty five. Automechanic.

Diagnosis Recurrent dislocation of right shoulder

While in service (April, 1918) patient received dislocation of right shoulder. Had several recurrences. Admitted to hospital November 4 1920

x Ray negative.

December 6 1920 Ether operation. F J Cotton. Anterior incision made down to capsule of joint which was found to be lax. Burrell operation performed

Uneventful recovery. Active motion started in ten days.

January 3 1921 Sling removed. Arm down to side. Physiotherapy started.

Examined March 7 1921

Complaint None. No limitation of motion. Excellent result. At work at former occupation. No recurrence

Case XII—S. A. L. Age thirty three. Locomotive fireman.

Diagnosis Recurrent dislocation of left shoulder

While in service patient fell on extended arm, resulting in dislocation of shoulder. This was reduced and has been dislocated on several occasions since. Patient admitted to this hospital November 6 1920 for operation

x Ray revealed no pathology. Patient big powerful, exceptionally heavy muscled about the shoulder

November 9 1920 Ether operation. F J Cotton. Incision was made in anterior surface of left shoulder along the anterior edge of deltoid muscle. Muscle retracted and capsule of shoulder exposed. This was found to be quite lax and Burrell operation was performed. Double sling applied. Uneventful recovery. Active motion started in two weeks.

Examined March 7 1921 **Complaint** None. No dislocation since. Has complete range of motion

I have seen no cases of recurrent luxation following an original trauma in which there was any essential pathology save the loose capsule. No fractured glenoids, and only one

April 6, 1921 an inquiry from the Federal Vocational Board' surgeon was received, asking if this man might take up steamboiler training. I wish I felt safe in recording my answer.

case of flat small glenoid, in a boy whose first luxation was in his 'teens.

There has been I think, some confusion of mind produced by failing to distinguish these from the paralytic or obstetric cases of posterior luxation, which are practically never of honestly traumatic origin.

I confess I can see no sense in the muscle-shifting 'stunts.'

One may not argue as to the *permanence of cure* of any of these cases shown for another year perhaps, but they are good so far.

There was a fourth case in this series. He is at work 40 miles out of Boston and unavailable. This case was interesting because he was a huge, powerful chap and to make sure I reefed in so much capsule that I limited his abduction and rotation so that it took him over six months to get back full free motion. He got it, however and now after a year the shoulder has not gone out.

Old Cases Sternoclavicular Luxation.—Case XIII—
J R. K. Age twenty-one. Draftsman.

Diagnosis Dislocation of sternal end of left clavicle with partial loss of function of left arm from injury received in France in April, 1918 when buried by explosion of shell.

Admitted to hospital July 14 1920

Examination negative except for conspicuous up and inward dislocation of sternal end of left clavicle which is freely movable.
x Ray report July 28 1920 Enlargement of left sternal clavicular joint with slight dislocation and apparently a small area present which would be consistent with a piece of loose cartilage in the joint.

July 29 1920 Operation by F J Cotton. Joint cartilage loose removed and joint suture set in through drill holes in both bones across inside of joint. Close suture of anterior capsule. Uneventful convalescence. Discharged from hospital September 8 1920 Improved.

Examined March 7 1921

Cured. Full function Almost no deformity Very little thickening

Old Cases Arthroplasties.—Arthroplasties are anything from excisions to joint reconstructions. If one gets perfectly free motion it usually is at the price of instability. Whether one uses an insert, Allison-Brooks 'silverized' or tached fascia, as here, or the autogenous fat flap I have usually contented myself with, or nothing at all is perhaps not so important as we used to think. Such operative technic as gives the best postoperative reaction, and therefore the earliest chance for motion is a very important item.

Case XIV—J F B Age twenty-six. Occupation Steam fitter's helper

Diagnosis Old gunshot wound of left elbow involving end of humerus, ulnar and radius. Ulnar nerve severed completely

Wounded in action September 29 1918 in France Left elbow Treated in France and at Camp Devens, Massachusetts. At old No. 10 Hospital had nerve suture performed (F J Cotton) with anterior transplantation. Admitted to this hospital on account of complete bony ankylosis of the left elbow with paralysis of the ulnar nerve. Much improved, and still improving but not cured. Arthroplasty has been postponed deliberately to give time to get clear of latent sepsis and for physiotherapy treatment to loosen scars and better the nutrition.

Ether and operation July 29 1920 F J Cotton Incision was made down to the bone of elbow which was found to be completely ankylosed. Ulnar nerve was isolated and carried temporarily to one side and bone forming ankylosis completely excised. Lower end of humerus was trimmed off forming blunt wedge. Ulnar and radius trimmed off to form loose-fitting joint. A piece of Allison-Brooks membrane was fastened about lower end of humerus. Tissues closed and arm put in plaster cast at right angle

August 18, 1920 cast was removed. Wound clean and healed wearing sling during the daytime and cast at night. Patient receiving physiotherapy treatment. Motion was gradually restored, until (March 7 1921) patient shows almost complete restoration of normal function. a good deal further advanced

than before this last operation. Ever since operation the *working* use of fingers much better

Flexion full. Extension full. Rotation 75 per cent. Lateral instability slight, perhaps 15 degrees of motion laterally

Case XV—H. M. Age twenty-six.

Diagnosis While in service received gunshot wound of right elbow causing compound fracture of radius and ulna. This resulted in severe sepsis. Patient is also suffering from epilepsy following kick by horse in 1917

Admitted to this hospital February 3 1920 Ankylosis of right elbow arm held at 95 degrees flexion.

November 22 1920 Ether and operation. F. J. Cotton. Arthroplasty without insert.

Examined March 7 1921 Flexes to 80 degrees. Extends to 130 degrees. Rotation 50 per cent. Motion still improving

Case XVI—T. J. K. Age twenty Occupation, student.

Diagnosis Old gunshot wound of lower third of left leg

June 21 1920 Admitted to this hospital, complaining of pain and stiffness in left ankle aggravated by walking or standing

Examination reveals long linear scars over both medial and lateral side of left lower leg and small scar over tendo achillis, dorsiflexion about 30 degrees short of a right angle, foot held in equinus. Patient gives history of having had osteomyelitis and gas bacillus infection. Received Dakin treatment for five months. Had several sequestra removed from fibula and a secondary closure done at Baltimore January 1919 Healed nicely but with a marked equinus probably due to prolonged use of splint without support of fore-foot.

Patient was seen by Dr. Rogers and tenotomy of tendo achillis performed without relief of equinus. Obstruction was bony

September 29 1920 Ether and operation. F. J. Cotton. Plastic excision of left ankle performed. Leg put up in plaster of Paris.

Examination March 7 1921 Is wearing leg ankle brace with joint at ankle. Dorsiflexion limited at 95 degrees. Plantar

flexion at 110 degrees. Walks with cane, limp still considerable, with some pain.

This Case XVI did not get as good a result as hoped for or as good as he is going to get eventually but the method of handling an equinus deformity is perhaps new. This was a case in which tight scarred tissues all across the back of the ankle made soft tissue cross-cuts or plastics useless—as demonstrated. He had an equinus so extreme as to make him a cripple.

The operation was a temporary removal of the internal malleolus, and the preparation, with a "pattern-maker's" chisel

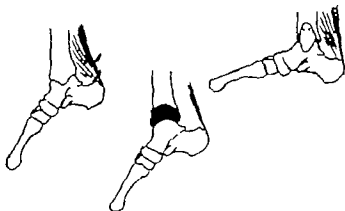


Fig. 369.—Diagrams of three stages of arthroplasty for contracture in Case XVI.

of 1½-inch radius, of a new tibial surface $\frac{3}{4}$ to $\frac{1}{2}$ inch up to fit the curve of the astragalus. The fibula was then shortened to fit, a section being cut away just above the joint level. The internal malleolus was then sutured in place (Fig. 369).

Old Case Old Tarsal Fracture Equinovarus Deformity—Case XVII—D O'L. Fracture of bones of feet, right, 1917. Result of fall into a trench. Admitted November 23 1920. Shows very marked talipes equinovarus. Weight carried clear out on to outer side of foot. Large framed, muscular man, in good condition. Attempt made to correct the deformity

by plaster Not successful Referred to F J Cotton January



Fig. 170.—Case XVII before operation.

13th. Operated on January 29th. Incision in longitudinal line of foot just below the scaphoid about 2 inches long. Vertical

incision of scaphoid. Forcible correction of deformity. Fragment of scaphoid kept apart by driving in a wedge graft from the tibia. In this way a very serviceable lengthening of the foot was obtained. Up on crutches February 26th. March 7th x ray in plaster shows almost complete correction. Boot with upright ordered.

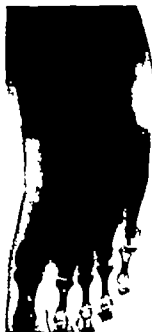


Fig. 371.—Case XVII after operation. Wedge in the split scaphoid.

This seems to be a very much better way. If one can do it, than to do a cuneiform osteotomy on the outer side of the foot, at best a destructive operation, shortening the foot and necessarily lessening its spring. In the case here cited there seems no reason why this foot in time with a bit of care isn't going to be as good as new (Figs. 370-371).

Old Cases. Compound Fracture of Both Legs. Major R. W. Browne. Dr. W. F. Cotting.—Case XVIII.—F. C. Age thirty

two. Employee of Boston Navy Yard. Stevedore Admitted to hospital August 12 1920

Diagnosis Fracture of right clavicle simple Compound, comminuted fracture of both tibiae

Present history While working at Navy Yard on August 12, 1920 was struck by a coal cable, which broke, and wound itself around patient's legs



Fig 372.—Right leg. Case XVIII



Fig 373.—Left leg. Case XVIII

Physical examination negative except for following On admission patient in considerable shock An abrasion on right shoulder fracture of right clavicle Compound comminuted fracture of both bones of both legs

Modified Sayre dressing for fractured clavicle. Wounds of leg cleaned, cauterized with 95 per cent. carbolic. Fractures manipulated, and plaster-of-Paris cast applied (Figs. 372-373).

± Ray report August 14, 1920. Commuted fracture of both tibiae at upper third. Fracture involves 6 inches of each. Position good. Right fibula—a transverse fracture at junction of middle and upper third. Position good. Left tibia has an oblique fracture at upper third. Position fair. Transverse fracture of right clavicle. Good alignment.

Uneventful convalescence except for slight temperature on first ten days.

September 8, 1920. Small fragment of bone removed from right leg. Left leg has been entirely healed for one week. Physiotherapy started. Right leg slow in healing. Occasional piece of loose bone removed from wound.

Discharged improved January 7, 1921.

Examined March 7, 1921. Walks without crutch or cane. Excellent result. Union solid.

Old Cases. Pseudarthroses. Bone-grafts.—It is to be noted that the cases of pseudarthrosis lately coming to this service are not comparable to those of civil life. Dating back in nearly all cases to 1918, septic for months, already operated on to secure union once or several times without success, they show wide defects of bone and ill-nourished bone-ends to a discouraging extent; no one is going to get *consistent* good results on this material.

Case VIX—J. H. Age thirty.

Machine gun bullet wound of left humerus. October 28, 1918. Admitted July 22, 1920 with flail joint in humerus, about 3 inches of tissue gone but this loss partly taken up by soft tissue retraction. Partial musculospiral paralysis persists.

Operation August 4, 1920. Usual anterior incision, excision of scar tissue, denuding and squaring of ends. In this case the soft tissues very redundant were well cleared and pushed out of the way. A graft about 3½ inches was cut from the left tibia near, not on, the crest, was set solidly into the remains of the medullary cavity below and then the upper end previously

sharpened to a stake was driven home by blows of a heavy wood mallet on the elbow the soft parts being held out of the way with retractors. Kangaroo tendon through lateral drill holes helped secure against slipping out and the arm well fixed, but right short was put up in plaster in sharp forward abduction and the patient kept a week in bed to let gravity help in



Fig. 374.—Case XIX. Pseudarthrosis before operation. Not the even, fusiform-looking cortical layer over the bone ends.



Fig. 375.—Case XIX. Bone-graft union. Clinically solid.

retention. On account of the nerve lesion a cock-up splint also applied to the wrist. There was no reaction.

Examined March 1921. Shows solid union, a much shortened but useful arm. Nerve lesion apparently entirely recovered (Figs. 374-376).

Case 33—J. M. Age twenty-eight.

Shrapnel wound 1918. Compound fracture of right humerus much loss of bone. Operated by Cotton in 1919 in United States General Hospital No. 10 for closure of wound. In spite of prompt closure he was advised to wait nine months or more for later operation on the bone (Fig. 377).



Fig. 376.—Case XXX. Ray, seven months.

Admitted January 1921 with loose flail arm. No nerve lesions. Upper fragment short, shoulder joint mobile within small range, elbow motion good. Long hairy scar about 12 $\frac{1}{2}$ inches on back of arm. Scarring in front not extensive. General condition good.

Operated on January 21, 1921. Long anterior incision from near coracoid down the front of the arm, fragment exposed ends cleared, and trimmed square. No medullary cavity above.

Graft from right tibia near the crest not the edge itself about $3\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ inches driven into the upper fragment and down into the medullary cavity of drill holes to keep ends from pulling apart. Arm put up in abduction on aviation splint. No reaction, prompt apparent union. Is being held in splints as a precaution arm seems perfectly solid at six and a half weeks. x Rays show fair bone formation (Fig. 378)



Fig. 377.—Case XX. Pseudarthrosis before bone-grafting

Case XX—J. P. Age twenty-three.

Gunshot wound October 15, 1918. Continuously under treatment since then. Bone-graft from tibia August, 1919. No union. March 1920 I did a bone graft with an intra medullary splint of boiled beef bone from the Hollister-Wilson laboratories, and cross-pinned the humerus with ivory pegs. No union. Graft broke some time after operation. There were never any nerve lesions, never severe sepsis. January 19, 1921 I operated again. By this time the loose pseudarthrosis had given way to a rather close one. Function of arm not bad.

I had encouraged use of the arm in the interim hoping to get better nutrition. The x-rays seemed to show success in this. The operation was as usual with the insertion into the center of each end a graft cut from the tibia, and lashing the bones together with kangaroo. Limb put in abduction first in plaster of Paris, presently a "Cleary" splint in abduction. No reac-



Fig. 178.—Phot. of Case XX at week last

tion but union very slow. Condition forty-five days later shows some apparent bony repair. There is still a trace of motion at the site of fracture and I am by no means sure we are going to get bony union. For the present as precaution, he is kept in an abduction splint.

Case XVII—E. L. G. Age twenty-nine. April 11 1918 arm broken as a result of fall. This fracture was compound.

Since this was written apparently rigid bony union has occurred.

and the arm was operated on five different times before entry here. Operation September 1918 Removal of necrosed bone. October 1918 and November 1918 attempted union of bone with sutures. June, 1919 intramedullary splint, beef bone. Still has a loose pseudarthrosis of left humerus, high up. Operative scars in plenty. Motions of upper fragment so much



Fig. 379.—(See XXXII) Old pseudarthrosis, very loose and half smooth after bone-graft operation looks protruding.

Limited as to make preliminary operation necessary. Admitted November 29, 1919. Operated December 1, 1919. Plastic operation to remove axillary scar, to tenotomize the pectoral and latissimus and to mobilize the upper fragment. Physiotherapy treatment up to the second operation January 24, 1920. Usual operation graft from tibia. At ten days a portion of the wound quietly broke down, cleaned up under Dakin

solution promptly. Healed in about four weeks entirely. Splint continued. Discharged March 17th. April 15th slow increase in callus formation. Union not yet solid. June 9th still not solid. Is wearing small sleeve splint. Examined March 7 1921 shows close fibrous pseudarthrosis, with very considerable improvement in function of arm. Not a solid union, but *tending to grow closer with use rather than to loosen up* (Figs. 379-381)



Fig. 380.—Case XXII. One month later; no new bone pseudarthrosis shaping again.

Case XXIII—Pseudarthrosis tibia bone-graft.

H. S. S. Compound fracture of left tibia upper end, from motor truck accident. Osteomyelitis with eventual non-union. Has had a number of operations. Entered November 9 1920. Fibrous union with marked loss of bone tissue just below spine of left tibia and consequent extreme bow-leg deformity. Fibular head displaced up and out.

November 15 1920 Operation. Incision—denudation of fragments and freshening and trimming up of all fracture sur-

faces. Fibula not touched. Very forcible stretching into position as near a straight leg as may be. Bone-graft from tibia of other side about $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ inch set and wedged in between fragments with limb on a stretch, and straightened graft held firmly by the elasticity of tissues. Plaster. Fitted out March 1 1921 with retention apparatus—lateral steel uprights.

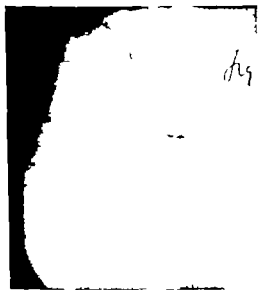


Fig. 331.—Case XXII. Seven weeks later. Pseudarthrosis complete. Total failure as to bone union, though with more useful arm.

Up and about union not yet fully solid, but very promising nearly certain I think, but likely to need some apparatus protection for security for some months to come.

Old Cases. Fracture of Forearm Mahanion.—Case V V I
—J S. Admitted January 5 1921. Age twenty two. Injured by propeller blade June 5 1915 at Fort Silla, resulting finally in loss of part of right hand, outer side, and third and fourth fingers on the right hand. Compound fracture of bones of forearm on left. Shows extensive scarring of the arm and a

fracture of both bones bent down and in to an angle of not less than 50 degrees. A good deal of disability as far as the hand is concerned largely due to the mechanical disadvantage of the angulation. Operation advised. Operation carried out February 12th. Excision of massive scar over and about the radius. Division of radius, which was solid. Shortening of same with rabbeting of the ends to a length that gave a straight ulna, there being a pseudarthrosis of the ulna. Developed an infection. Definite, though never very severe culture showing *Staphylococcus albus*. Still in hospital. Cleansing under Dakin treatment. Wounds not healed but with no active infection and with union already beginning. In spite of the technical misfortune result is apparently going to be good.

Old Case. Compound Fracture of Humerus Osteomyelitis Massive Sequestrum Notable Reproduction of Shaft.—Case XXV—P. C. G. Age twenty-five Occupation Printer

Diagnosis Old gunshot wound resulting in FCC of humerus, ulnar and radius, and upper end of humerus, right arm

July 25 1918 while in action at Chateau Thierry patient was struck by high-explosive shell, causing fracture of humerus, ulnar and radius, also of the upper end of humerus. Patient was treated t field hospital ten hours later where amputation was advised. Patient refused amputation and Dakin treatment was instituted. This was continued until November 1918

x Ray showed at this time regeneration of bone and on operation 9 inches of humeral shaft was found to be sequestered. This was removed and arm put in extension in Thomas arm splint, with Dakin treatment. Operation was performed by Lieutenant Dunn, of Minnesota, Johns Hopkins Unit

When splint was removed patient had about 50 per cent of elbow motion, and on being transferred t the States plaster cast was applied. On arrival in the States the plaster was removed and elbow found t be completely ankylosed. Numerous sequestra were removed from elbow region.

On January 3 1921 patient fell on subway stairs causing

fracture through callus at elbow. Was treated at this hospital arm in plaster cast.

Examined March 7, 1921. Fracture repaired, elbow still ankylosed, shaft solid, no sinuses (Figs. 382-384).



Fig. 382.—Case XXV. X-ray each sequence of shaft of humerus.



Fig. 383.—Case XXV. Photograph, present date.

Old Case. Jaw Fracture with Deformity.—Case XXXI—
 G. R. C. Age twenty-five. Carpenter's helper.
 Diagnosis. Fracture of inferior maxilla, simple, right side.
 Admitted to hospital April 26, 1920.
 Past history. On July 5, 1918, was struck by butt of rifle.

at naval bayonet practice and received a fractured jaw. The diagnosis was not made until three weeks after injury. Apparently no treatment at any time. Since then jaw has bothered him considerably and he has been unable to masticate on that side since injury. Front teeth do not meet within an inch. Deformity very disfiguring, face one sided, mouth open.



Fig. 334.—Case XXV. Ray: present date

x Ray shows complete fracture of the right mandible lower starting behind teeth, running down and back t angle

April 30 1920 Patient operated on by Dr. Cotton and Dr. C. C. Cole, dentist. Open osteotomy performed on fractured lower jaw. Teeth were wired.

May 8 1920 Teeth rewired by Dr. Cole

Uneventful convalescence Discharged July 29 1920 No complaints.

Examined March 7 1921 Only fair occlusion but teeth meet, jaw solid.

Old Case. Ulnar Nerve Suture —Case XVIII—J F D
Age twenty-one. Occupation Teamster

Diagnosis Gunshot wound of left forearm, resulting in nerve paralysis.

In July 1918 while in action, patient was struck by shrapnel in left forearm Was treated at base hospital, where median nerve was sutured. Admitted to this hospital November 8 1920 Examination at this time showed typical picture following ulnar paralysis. Fingers contracted considerable atrophy and vasomotor changes.

Patient was seen by Dr Cotton, who advised suture of ulnar nerve

Ether and operation F J Cotton Incision was made and ulnar nerve found. There was no actual division found, but the nerve was considerably atrophied and shortened. Nerve was transplanted anteriorly to the internal condyle of the humerus Pad of fat was swung from the subcutaneous tissue and wrapped about the nerve. Wound closed with silkworm-gut.

Patient made uneventful recovery Wound healed. On December 8, 1920 physiotherapy started, active and passive motions, resistive exercises, whirlpool bath and Bristow coil. Banjo splint applied. Motion slowly returned in fingers, sensation practically the same.

Has been treated by P T Dept. up to this date.

March 7 1921 Fingers extended. Nerve regenerating P T daily and splint.

Old Case. Neuromata of Stump Excision Alcohol Injection.—Case XIX—O I Auto accident in France 1918 Injury to right arm followed by amputation. Painful stump of right arm for which he was admitted August 10 1920. In detail the painful areas in the stump are neuromata of the musculospiral of the median, and ulna respectively about

$\frac{3}{4}$ inch back from the stump end. August 11th stump was opened up these neuromata exposed 60 per cent. alcohol injected into nerve trunks well back of the neuroma and these trunks cut $\frac{1}{4}$ or $\frac{1}{2}$ inch behind the neuroma mass. Seen and discharged July 17 1920

Examined March 7 1921 Stump still sensitive, but not extremely so. No sign of redevelopment of neuromata.

Last year's work of Dean Lewis on the effect of alcohol infiltration in lessening neuroma formation seems conclusive, and such infiltration should, to my mind, be a part of the routine in every amputation or re-amputation.

Old Case. Bear Excision. Two-stage Flap-graft.—Case XXX—T V T Civil service employee. Age thirty-one Comes to hospital for surgical treatment of contracture of second, third, and fourth fingers of left hand, resulting from an injury in the palm of the hand July 1916. Has been variously treated including operation for transferring of free graft from thigh which was not successful. Fingers so contracted as to be of little use. Operated on January 19 1921 Two-stage plastic from abdomen to palm, and after dissecting out of a rather massive scar involving all the flexor tendons of the palm as well as superficial tissues. Graft left attached and hand hitched to abdomen for ten days when graft was out half way through. Dissection completed on eleventh day Is still getting physiotherapy treatment and exercises to get back motion of fingers. Is very nearly ready to have an operation for thinning the somewhat redundant graft. Massage and active motion now being supplemented with banjo splint. He has a sufficient amount of covering for the palm of hand without much contracture. Prognosis good.

In 1918 in an article in the *Military Surgeon* the use of these two-stage grafts for *lengthening unhealed stumps* was discussed. In reconstructural work they have a world of use. They are easy to do after one gains a facility the lack of which somewhat impairs one's first dozen cases of the sort.

Not so sure later but the procedure still part of my routine
Cotton *Military Surgeon*, 1918.

Old Cases. Tuberculosis of Palmar Tendon Sheaths.—
Case XXXI—C. G. O. C. Age twenty Occupation Silk
hose knitter

Diagnosis Tuberculosis of flexor synovial sheaths, left wrist.

Chief complaint Pain and swelling of flexor surface of
left wrist. About January 1 1919 developed pain and swelling
along flexor tendons of left wrist. Received various treatments
but none seemed to be of any benefit until November 1919
when he was discharged from service. Was unable to work
at his former trade on account of the above symptoms.



Fig 385.—Case XXXI Tuberculosis of tendon sheaths of wrist. Photograph showing condition and range of motion at present date. T exposure plate—extension and flexion.

Admitted to this hospital May 24 1920 and at that time
showed typical symptoms and physical findings of a chronic
tenosynovitis of flexor tendon sheath. Was seen by Dr
Cotton and diagnosis made of tuberculosis. Operation advised.

June 15 1920 Ether and operation. F. J. Cotton. Com-
plete excision of synovial lining of flexor sheaths of wrist and
palm. Sheath was found to be filled with rice bodies.

Wound healed by first intention and motion started early

Physiotherapy given and patient obtained full function in a few weeks. During the operation it was found necessary to remove portion of flexor tendon of little finger on account of tuberculous involvement. On account of this patient is unable to flex little finger. Was operated on and distal end of fifth flexor tendon attached to tendon of the fourth. Function gradually returned and patient presented very satisfactory hand. Was discharged from hospital and since then returned on account of recurrence of symptoms. Was operated on—opening made down to flexor tendons and a few rice-bodies expressed. A through-and-through irrigation of 7 per cent. iodine was made through wound in palm. It was found necessary to repeat this procedure at a still later date. In spite of this operative procedure patient has been able to maintain practically full function of hand.

Examined March 7 1921 Wound healing Nearly closed. Function still excellent (Fig 385)

Old Case. Tuberculosis of Tarsus.—Case XV VII—H McS Age twenty five

Two years ago following sore throat, had swollen neck gland which continued to grow worse up to seven months ago. Gland in left axilla became enlarged in 1918. February 1919 some of the glands in the neck broke down and were lanced. Since then gradually condition has slowly improved. About a year ago patient sprained right ankle, hurt it again four months ago. Some lameness since. On admission January 26, 1920 showed considerable neck glands still and glands in the left axilla. A few in the right. Apparently tubercular but not active. Blood, 4 668,000 red, 7300 white 80 per cent. hemoglobin. Hodgkin's question decided in negative. x Rays of ankle February 3 1920 show no pathology in bone. Treated conservatively with physiotherapy for some time, and from March on had treatment with x ray. x Rays March 2d showed doubtful process of upper left and right lobes. Transferred to surgical April 5 1920. Pain in right foot and swelling increasing. Some improvement under rest. Abscess on dorsum of

June 27 1921 solidly healed, function perfect.

foot opened March 31 1920 x Ray showed osteomyelitic process. Wound discharging. On April 21st x-ray showed increased bone destruction. April 24th curetage. Drainage. Dakin solution. May 13th x rays showed improvement clinically soft parts condition getting worse. Sinus remained open till August 10th, when he was transferred for operation. August 11th all diseased area cleaned out. Put up in cast. September 10th very little improvement as far as bone condition goes. Dakin continued. October 15th another sinus formed. From this time on grew slowly worse rather than better. Amputation considered. November 9th amputation of right foot point of election. Clean healing. Ideal stump. December 21st report on foot, guinea-pig inoculation positive tuberculosis. At time of this operation patient had glandular mass in the left axilla, which was operated on January 14 1921. Positive tuberculosis again. Report of J H Wright January 23 1921. Examined March 7th. Good stump. Has been discharged from hospital with artificial leg. Has returned to substantially normal general health from condition of much emaciation and weakness.

This is not the first case in which I have fooled away unnecessary time in trying to save a tubercular tarsus in an adult.

Old Case. Cancer of Floor of Mouth.—Case V V LIII — J F H. Age sixty-nine. Occupation Cook.

Diagnosis Epidermoid carcinoma, floor of mouth.

March 18 1920 Piece of tissue of tumor in floor of mouth removed and sent to laboratory for biopsy. Report was epidermoid carcinoma.

April 2 1920 Ether and operation. F J Cotton.

Complete excision of tumor from floor of mouth, including a bit of the base of tongue on right. Caustery to wound. Secondary acute infection of glands in submaxillary region followed.

Excision of glands of neck advised at later date. Meanwhile concentrated radium treatment by Dr C Wheland, with subsidence of said glands.

December 1 1920 Block dissection of right submaxillary triangle of neck performed on this date. Uneventful recovery. Examined March 1921. No recurrence anywhere.

A difficult case because the man is enormously stout, thick necked, and with none too good a heart. It would have been advisable to do the left side of the neck as well, of course, but his condition became such as to make this too risky. It is doubtful if there were ever any malignant glands. No malignancy in those removed.

Old Case. Stomach Ulcer—Case V V V V—J. A. S. Age thirty one. Laborer

Diagnosis. Gastric ulcer

Patient gives story of stomach trouble dating back to September 1918. While in service in France had symptoms as follows: Nausea, gas, heart burn and water-brash, coming on soon after meals. Was relieved by soda. Distress was usually relieved by vomiting coming on after meals. Never noticed any blood. x Rayed in France. *Diagnosis. Probable gastric ulcer*

Admitted to this hospital July 19 1920

x Ray examination negative for ulcer. Treated by Medical Surgeon until October 6 1920 when he was transferred to Surgical Department for exploratory laparotomy.

October 6 1920 Ether and operation. Dr. Cotton. Posterior gastro-enterostomy was performed. Ulcer on gastric edge of pylorus stomach opened and explored crater of ulcer about $\frac{1}{2}$ inch. Walls moderately heaped up not hard pylorus not actually involved.

October 7 1920 Patient had a very poor night vomited large amount of blood. Pulse rapid and weak 1000 c.c. saline solution given subpectorally. Patient grew progressively weaker. Blood transfusion done at 9.30 p.m. Citrate method used 750 c.c. given.

October 8 1920 Patient's condition much better except for an abscess of the abdominal wall, which was opened and drained. Patient's recovery was uneventful.

Examined March 7 1921. Complaint, none

Gained 40 pounds since operation.

Case interesting because my exploration of the ulcer undoubtedly stirred up the very serious bleeding.

Old Case. Hemolytic Jaundice Splenectomy Complete Recovery—Case 1 Y Y V —J J S Age twenty-seven. Lieutenant of Coast Artillery

Diagnosis Splenic anemia.

Admitted to this hospital March 2 1920

Family history negative Past history unimportant except for malaria six years ago

Present illness Has been in several hospitals with diagnosis of splenic anemia. Eighteen months ago had a sharp severe pain in left side immediately following which patient became intensely jaundiced.

This jaundice persisted for two weeks before improvement began.

Chief complaint Weakness, drowsiness, feels lary and sluggish at all times. Sleeps a great deal, but can be easily aroused Cerebration rather slow Patient complains of difficulty in concentrating No vertigo syncope indigestion nausea vomiting constipation, or diarrhea. Has had frequent persistent nose-bleeds during past six months.

Eyes Right pupil larger than left, but both are regular and react to light. Movements normal No nystagmus. No strabismus Sclera and skin show slight jaundice. Physical examination negative except for abdomen, which is extended non tender except over spleen, which reaches downward to umbilicus and inward to median line Firm rounded no notch felt Liver palpated 2 cm below costal margin on deep inspiration.

Blood picture Blood examination made by Dr R C. Larrabee. Hemoglobin 61 per cent. R. B C 3,500,000 Color index. 87 Platelets, 300 000 Slight achroma. Moderate poikilocytosis. Reticulated reds 16 per cent. normal about 1 per cent.

Diagnosis Probably acquired form of hemolytic jaundice Splenectomy advised.

May 28 1920 Splenectomy under ether by F J Cotton.

Uneventful convalescence except for temperature the first three days after operation of 100° F Jaundice cleared up

and patient up and about the ward June 17 1920 Blood picture normal July 12 1920

Discharged improved August 17 1920.

Old Case. Undescended Testis.—Case XXXVI—E. S. S
Age twenty-five. Machinist's helper

Diagnosis Hernia, inguinal, indirect, right.

Patient states that he never had any trouble before entering the army First time that he complained was on the boat going to France October 1918 While lifting a heavy bale he got a stitch in the right groin. Was examined by a doctor who said he had a hernia.

Admitted to this hospital December 2, 1920

Examination reveals undescended right testicle. Impulse felt through inguinal ring Ether and operation December 27 1920 by W. F. Cotton

Right inguinal incision made and tumor mass found opposite internal abdominal ring This was opened into and by traction testicle of normal size and consistency was delivered. Testicle was replaced within the abdominal cavity Internal ring closed with chromic gut. Bassini herniotomy was performed

Patient made uneventful recovery Developed small stitch in three weeks, which cleared up under treatment.

Patient was discharged relieved December 27 1920.

A few weeks ago local doctor called up hospital and made report that patient was suffering from left inguinal hernia, and in great pain. Patient was admitted to this hospital and examination revealed left epididymitis. Patient gave story of Neisser infection and diagnosis of G. C. epididymitis made. Epididymotomy was performed and epididymitis found to be extended with pus. This was relieved by multiple stab wounds and tunica drained.

Uneventful recovery

Hip Gunshot Wound. Compound. Old. Conservative

Reported to me as entirely normal in blood picture, by Dr. Beckman, June 25, 1921. Seen by me June 10, 1921, and entirely normal on gross examination, and in vigorous health.

Treatment. Result.—Case \ \ XVII—E. M. Age thirty five. Occupation Nurse

Diagnosis Arthritis, acute (suppurative) right hip-joint.

P. I. Ambulance case from Lynn Hospital, where he was treated for 'rheumatic fever'. In August, 1917 patient reported sick with backache. Relieved by aspirin. Has had occasional attacks of vague pains in back and joints of arms and legs since. Three weeks before this sickness he had pain in knees and ankles. Then developed pain in right hip and was unable to walk. Since confined to bed. Fleeting pains in joints.

Admitted June 1 1920

Right hip slightly swollen. Is painful to touch and motion. Some pain in left shoulder and a decided limitation of motion due to pain. Joint not swollen

Right leg in abduction. Foot everted, pelvis tilted apparent shortening. Acute hip spasm etc.

x Ray negative.

June 3d Seen by Dr. M. W. Rogers. "Acute hip. Severe type. Probably not T. B. Advised traction. To consider operation. W. B. C. 6000. Temperature normal to 100° F.

June 5th W. B. C. 13,300 Wassermann negative. Traction, with relief

June 14th Operation by Dr. Rogers. Pus found in hip-joint, wick inserted. Plaster spica and Bradford frame. Culture Streptococcus pyogenes.

June 20th Wick out. Wound draining small amount.

July 7th Patient sitting up

July 15th Crutches. Cast off

September 14th Short spica to relieve pain.

October 20th Cast off Crutches. Examination shows improvement. Very slight muscle spasm

November 1st Short spica

January 6 1921 x Ray Irregular outline femoral head and acetabulum

February 23d Transferred to Convalescent Home.

Salivary Fistula.—Case \ \ \ III—O. V. R. Age thirty Occupation Longshoreman.

Diagnosis Salivary fistula resulting from gunshot wound of left side of face

On June 18 1918 at Chateau Thierry while in action, patient was struck by fragment of high-explosive shell.

Admitted to this hospital and operation performed to close salivary fistula, under ether. Incision was made into the little sac existing behind the fistula in the parotid gland, and a ureteral catheter was inserted from within the mouth, through



Fig 386.—Case XXXVIII. Healed salivary fistula. Fistula enter section of be lices sketched in

Steno's duct to the fistula and into the opened pocket in the gland, running from gland. Fistula excised. Tissues sutured over catheter in three "shingled" overlapping layers. Tube was removed after several days and artificial duct was found to be functioning. Following this treatment patient's only discomfort was a small area inside of cheek, which remained unhealed. This was curetted and finally healed.

Examined March 7 1921. Cured (Fig 386)

This is not a usual method, at least, of dealing with these fistulae. Here there was no proximal end to the duct at all to put through the cheek to the mouth. Steno's duct is not hard to catheterize, but I was doubtful how well an indwelling catheter would be tolerated. There was no trouble and only the least leakage and oddly enough, apparently never any tendency to stricture.

Case XXXIX.—Brain wound aphasia grafting for skull defect.

J. C. A. September 12 1918 received gutter wound of left parieto-occipital region, with dural and brain penetration of fragments. Conscious. No sign of paralysis, but unable to talk vomiting pulse 54 blood-pressure 130/75/55 Wound, transverse, tangential, left occipital region measured 10 by 4 cm. ragged edges of torn scalp exposed brain with evident loss of brain substance Roentgen ray report No foreign body in brain. Indriven fragments of bone left occipital region. Foreign body (high explosive) 18 by 10 mm in lower end of right tibia.

Neurologic findings Aphasia. When asked when he was wounded, answered tonith Recognizes objects, but is unable to call their names properly Unable to write name though he spells his name J-O-H N as he attempted to write it. Loss of muscle sense in right hand (is right handed) No loss of sensation to pinprick right or left. Slight weakness (emotional) right side of face. Right-hand grip weaker than left. Pupils dilated, but equal Abdominal epigastric and cremasteric reflexes absent right and left. Babinski reflex present right, suggestive left A complete right homonymous hemianopia.

(Operation September 12 1918 (twelve hours) Pulse had come up to 80 Novocain-epinephrin after $\frac{1}{4}$ gr morphin. Block removal of bone débridement of brain by suction with removal of numerous bone fragments and considerable contused brain substance Edges of dural wound 2 by 1.5 cm excised. Two bleeding points tied Scalp closed with interrupted silk-worm-gut \ drainage

Wound of leg dressed removal of shell fragment.

September 13th Pulse 100 Tries to talk, but unable to call objects by their proper names. Eye-grounds normal.

September 14th Pulse 80 Able to say a few words.

September 15th Aphasia slightly improved.

September 17th Aphasia improving Hemianopsia the same

So far from notes of Mobile Hospital No. 1 Dr. C. E. Downman.

From Mobile No. 1 went through three hospitals till he came to Brest. November 11th returned on an army transport to Newport News thence to a base hospital, and on December 7th was discharged to report in Boston.

He was found by friends in Boston, entirely lost, totally aphasic, and taken in an ambulance to United States Army General Hospital No. 10

At this time his aphasia and agraphia were complete, he was confused, worried and apparently suffering from severe headaches mainly about the wound. The wound was not only wide and pulsating but on coughing or stooping the brain contents bulged over an inch through the opening restrained but little by the thin, soft covering of scalp. Such bulging was painful and increased his discomfort and mental confusion.

After prolonged rest he improved began to be able to make semi-intelligible answers, and at least thought connectively for short periods. The hemianopsia subsided. There were periods of painful numbness and weakness of the right arm but never any real Jacksonian symptoms. The agraphia remained complete. He was put in charge of a special aide to oversee his education, and she by patient effort brought him to a point where he could talk intelligently and write fairly well though he tired easily as a result of physical or mental tension, and had mental processes very distinctly slowed.

Also there were persistent dizziness and headaches, and because these things were troublesome and in some part at least due to the irritation of the in and outgoing brain in the big gap in skull and dura, I decided to roof in the skull

This was done in August 1919 under ether sections of

rib (his rib) being used split on the flat, and each piece grooved at the ends to fit the sharpened skull edge, and sprung and "swedged" tightly into place and covered in with the scalp. No opening was made into the scarred but flexible dural tissue.

There was a little mental reaction after the operation, but within a fortnight he had returned to the same condition as before, save for a very decided improvement as to headaches and dizziness.



Fig. 387.—Case XXXIX. Repair of skull by bone-graft from rib.

Since then he has improved and today is normal in appearance and in conduct, can speak clearly and shows only a certain slowness of thought and speech. He still tires easily and has been unable to go on with a technical training for which he is very eager. Fatigue and excitement or emotion accentuate the hesitation of speech and if extreme bring back the aphasia in part, and at times the numbness and weakness of the right arm and hand. There is no hemianopsia. Headaches are not

severe or frequent. There apparently are no symptoms referable to brain pressure. No disturbance referable to the wound. The scar pulsates over a very small area at the lower corner. Otherwise the skull is solid, the grafts having "taken" and grown their rib curve just about matching that of the skull (Figs. 387-388).

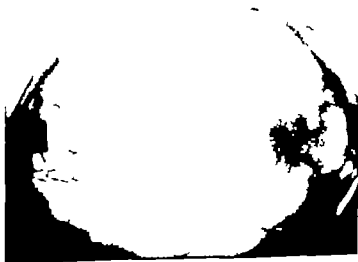


Fig. 388.—Case XXXIX. Rib-grafts in defect of skull solidly healed in place.

Case XL.—J. F. L., Laborer. Age thirty-three. Tuberculous of knee excision.

In 1919 without trauma began to have slight trouble in standing and knee swelled. Suddenly worse after slight bump. Lame history but treated. On entrance (June 14, 1920) showed muscle atrophy knee in flexion, swollen, hot, slightly reddened, not very painful, but almost entire loss of motion. Synovial thickening considerable. X-ray shows good deal of bone destruction. Diagnosed as tubercular (Charcot joint excluded.)

October 6 1920 Operation. Type excision with fixation by slender ivory pegs. Cast. A typical excision, but with an extraordinary amount of synovial proliferation and destruction.

In spite of this, save for a little leakage for a fortnight or so beginning at six weeks the course has been uneventful



Fig. 389.—Case XL. Excision of knee for tuberculosis. Condition at three months.

He has now a solid knee left nearly straight, because a good bit of bone removal gave shortening and because he is a laborer with no sitting to do professionally at least (Fig. 389)

Case XLI—Os calcis fracture remodeling with mallet.

J. H. Foundry molder. Age fifty three

Fell downstairs. Entered February 16 1921

Fracture of the common compression type of the left os calcis. Examination showed the usual broadening out beyond

the plane of the external malleolus in this case. Lateral motion much limited. Crepatus on motion. \times Rays showed usual picture.

February 22 1921 Ether Remodeling of the os calcis, particularly a shoving home of the heavy projecting outer plate into its place under the outer malleolus. For this a heavy mallet is used with the foot rolled inward over a sand-bag. In this case the remodeling went well. Then the lateral motion, having been cleared fairly well by rocking motions, the foot was put up in plaster with pad pressure below the external malleolus.

Three and a half weeks later the cast was removed and motion begun. He began to walk at four and a half weeks, and now shows little deformity and very fair lateral motion, no flat foot, not much pain. The result should be a useful foot, even if less springy than normal. Without remodeling we should have had a foot locked against lateral motion, with steady pain from pressure of malleolus on the outgrown calcis—a crippled foot.

CLINIC OF DR DAVID CHEEVER

PETER BENT BRIGHAM HOSPITAL

TUBERCULOSIS OF THE MAMMARY GLAND

THIS patient (I G Surg No 13 988) presents a condition probably more common than is generally supposed and correspondingly more important. She is a Jewish woman, thirty seven years of age, married, who has had 3 living children, the youngest one year ago. Her family history shows no tendency to familial disease. Her past history is one of uninterrupted good health. Her first two babies, born thirteen and ten years ago were nursed for many months without any incident. The third baby born one year ago was nursed for about four and a half months, when the left breast began to be tender swollen, painful and red. She says it was incised by her local doctor with evacuation of pus the drainage continued for about three weeks, by which time the wounds were healed. Soon afterward the patient noticed a hard lump in the upper and outer quadrant, which was sometimes the seat of stabbing pains. She consulted several doctors without obtaining relief and four months ago was an inmate for one week of a neighboring hospital, where hot applications gave relief from pain. Since then, and more especially during the last two months, she has noticed that a more definite mass has developed of increasing firmness, but without much pain. There has been no discharge from the nipple, and the old incisions have remained healed. Recently she was seen in our Out-door Department and was at once recommended for admission. Before discussing the diagnosis let us make an examination.

There is no need of lingering over the general physical examination except to say that it shows a woman in apparently

perfect health except for the affected organ. Both breasts are large full and pendulous and the right is actively lactating, and normal in other respects. The left breast is distinctly larger than the right and of generally firmer consistency. It is more full in its upper and outer part, and palpation shows a hard firm induration, which when the breast is picked up from the chest wall, makes a mass the size of a small fist. It is not tender. Its periphery is ill defined and shades off somewhat gradually into the surrounding tissue. The skin overlying it is not reddened but is distinctly immobile over the underlying mass, and when an attempt is made to pinch it up it presents the familiar pig-skin appearance. There is no increase in surface temperature. The nipple, which she states was formerly normal, is retracted nearly out of sight, and shows no discharge. The scars of three small incised wounds well healed are noted below the nipple in no relation to the mass. Examination of the axilla and the base of the neck fails to show enlarged lymph-nodes.

What is the diagnosis? Consider again that a woman of thirty-seven presents a hard, insensitive mass in the breast, of some months duration, increasing in size with depressed adherent overlying skin and retracted nipple. We would be criminally negligent if we did not consider first carcinoma, and it was with this presumptive diagnosis that the patient was instantly referred for admission for exploration. The characteristics which seem to be inconsistent with carcinoma are indeed few. The mass is not quite so hard as the usual carcinoma, especially of the scirrhus type. Its periphery appears to be unusually vague. It seems unusual not to find axillary metastases in connection with so massive a growth. Its occurrence during lactation, and appearance after the drainage of a breast abscess, suggests that it may be a persistence of pyogenic infection, but certainly the long duration and the absence of most of the usual signs of inflammation seem to rule this out. The patient's temperature and leukocyte count are normal. Above all things, we must not allow our minds to be diverted from carcinoma simply because the process began

in a lactating breast which is so commonly the seat of suppuration. Cancer of the lactating breast is not infrequent, grows with great rapidity and is usually of the rather soft medullary type conforming in many respects to the characteristics of the case before us. The diagnosis is often missed because it is mistaken for an inflammatory condition, until the only possible hope of cure of this horribly fatal lesion is lost through delay.

What other diseases of the breast must be considered in diagnosis? It resembles no other neoplasm unless possibly sarcoma, which is relatively rare, constituting probably not more than 2 or 3 per cent. of breast tumors, and is usually circumscribed, nodular and rapidly growing. While sarcoma may occur in most varied gross and histologic forms, we have no especial reason to suspect it here and, after all since the treatment would be the same there is no need of attempting to differentiate it with certainty from carcinoma. A syphilitic gumma must be considered and a Wassermann test should have been made as a routine to exclude it. Gumma of the breast is rare, and if it had existed as long as the present lesion and reached its size, it would almost certainly have broken down. In a woman who gives no history of lues and shows none of its stigmata, this rare tertiary form can be ruled out. Actinomycosis occasionally attacks the breast, very rarely as a primary invasion usually as an extension from an intrathoracic lesion. Tuberculosis must be considered. Other diseases, such as sporotrichosis, attack the breast but are so excessively uncommon that as a practical matter they do not deserve serious consideration.

Having considered the diagnosis and admitted its uncertainty we are fortunately in no doubt as to the proper course to pursue. We must first obtain the patient's unqualified consent to whatever operative procedure, however extensive, we may find to be necessary. This precaution is absolutely essential in women where there is the slightest possibility of the necessity of removal of any of the pelvic organs or of the breast. It is a great shock to a woman to realize that organs peculiar to her sex have been removed—that child bearing is impossible.

She may have wished for no more children and may have expressed annoyance at the discomforts attending menstruation, yet the passing of these functions represents to her the transition from youth to age, and may be bitterly resented. For somewhat similar reasons the mutilation or removal of the breast is peculiarly shocking. Failure to obtain explicit consent may involve the surgeon in recriminations or even in litigation.

After the usual preoperative preparation the patient is anesthetized, preferably with nitrous oxid gas and oxygen, an incision is made into the most characteristic part of the lesion, and a small piece removed for immediate frozen section and diagnosis by a competent pathologist, and the wound instantly cauterized, preferably by the actual cautery or if this is impossible, by some powerful escharotic agent. It is not justifiable to postpone the final operation until the tissue can be sent to some distant laboratory for examination. If immediate histologic diagnosis cannot be made, it is wiser to rely on the experienced surgeon's knowledge of gross pathology or to send the patient to some clinic where the facilities are adequate.

In the case of our present patient the incision shows normal breast tissue interspersed by firmer fibrous-like areas, and others of soft, pale, friable tissue. One or two small pockets containing a drop or two of thick pus are encountered. Immediate examination of this pus shows no organisms, and histologic study of the tissue by frozen section is returned by the pathologist with the diagnosis of a chronic inflammatory process showing giant cells and no evidence of neoplasm. Our suspicions of tuberculosis are at once aroused by this combination of chronic inflammatory tissue containing giant cells and bacteria-free pus. Unfortunately the definite diagnosis of tuberculosis cannot be made from a frozen section, for we know that giant cells may be expected in any chronic process where nature is attempting to destroy and absorb noxious material. It will require more elaborate technic, the preparation of paraffin sections, and perhaps the inoculation of a guinea-pig.

The proper procedure now is to remove the breast cleanly

and explore the axilla but, unfortunately the patient has insisted that the whole breast shall not be sacrificed except for malignant tumor. Fortunately by excising the upper and outer quadrant of mammary tissue, we can remove apparently completely the affected tissue, and examine the axilla whose lymph-nodes prove to be normal. The breast is quite satisfactorily reconstructed by buried plain catgut sutures, and the skin is closed with silk, leaving a small drain of protective gutta-percha tissue in each angle. We shall advise a massive radiation of the breast and axilla with x rays as a prophylactic measure, because this, in our experience has a distinct therapeutic value in tuberculous adenitis.

Contrast this case with that of this other patient (Mrs. G. R. F. Surg. No. 14,295). She is a young married woman twenty-three years of age, who has always been, and still considers herself to be exceptionally healthy. She has one child living and well at the age of four years. She has never been exposed to tuberculosis. Six months ago she noticed the spontaneous appearance of a small lump in the left breast, below the nipple, without coincident pain. Four months later after having been poulticed for three weeks, the lump enlarged somewhat, opened spontaneously discharged and subsided considerably leaving a small granulating area. Two weeks later the swelling reappeared, and two other superficial ulcerations have developed and persisted. At times there is a sharp pain over the swollen area. The patient has noted no discharge from the nipple and no glandular swelling in the axilla.

Physical examination shows an exceptionally healthy appearing young woman whose only other deviations from the normal are hypertrophied toenails and a few carious teeth with pyorrhea. The left breast is slightly larger than the right. The nipple is not retracted. The skin is normal except that about 4 cm. below the nipple is a group of three very shallow ulcerative lesions each surrounded by an area of purplish congestion. The edge of each ulceration is undetermined and irregular the base varies from a pink to a gray color and subjacent to it is a thickening of the tissues which individually does not amount

to much but collectively with the others forms a conspicuous mass when the breast is picked up from the chest wall. This mass is not tender but the small ulcerations are exceedingly sensitive if touched. The skin elsewhere over the mass is not adherent. There is no sinus or deep discharge. The pectoral group of axillary nodes shows that several are slightly enlarged, rather soft and insensitive.

Here is a lesion not difficult of diagnosis. It has none of the characteristics of tumor. The sensitive, shallow ulcers, with irregular purplish undetermined borders, overlying a thickening of breast tissue, suggest one of the chronic granulomata. The Wassermann test is negative and there is no hectic history so that a gumma can be excluded. Moreover stained scrapings and fluid from one of the ulcers have shown acid fast bacilli consistent with those of tuberculosis. We are perhaps surprised, as in the first case, that the patient is in such vigorous health, but, as a matter of fact, we know that peripheral tuberculosis is not necessarily accompanied by debility.

We will proceed by the same method as before. Under gas-oxygen anesthesia an incision is made through the base of one of the ulcers and a piece removed for diagnosis, the incision being at once cauterized. Dr. Wolbach reports that examination of frozen sections shows giant cells consistent with tuberculosis, and he is willing to make that diagnosis, although stating that giant cells may be found also in simple chronic mastitis. Certainly the sum of our evidence justifies the diagnosis without the demonstration of bacilli in the tissues by finer histologic methods, or guinea-pig inoculation.

The breast is removed by an elliptic incision beginning over the tendon of the pectoralis major opening up the axilla from which the areolar tissue and fat is removed *en masse* with the mammary gland and the pectoral fascia. The most important thing in connection with the incision besides the affording of proper access to the lesion, is the preservation of the axillary flap of skin, which insures perfectly free motion of the shoulder joint especially in abduction. The outer end of the incision must be kept in front of the anterior axillary fold lest in healing

PEPTIC ULCER AND GASTRIC NEUROSIS

Here are 2 patients whose cases are completed, and afford a most useful contrast in diagnosis.

Mr J J fifty five years of age married Surg No 13,990 presents a perfectly normal family and previous personal history. He is an industrious man, a woodworker supporting his wife and 2 children. Twelve years ago he began to have moderate epigastric discomfort coming on two or three hours after eating, with eructations of gas and watery material. This group of symptoms came in recurring periods, lasting perhaps a month with intervals of several months of well being. No nausea or vomiting. Seven years ago he had a sudden faint turn, was taken home regurgitated small amounts of "coffee-ground" material, passed large dark stools, and felt unaccountably weak. Recovery was prompt, and he has gone on much as before until about eight weeks ago, when the symptoms became somewhat worse. He is apt to lie awake at night on account of the pain. Recently he has felt faint and weak. Two weeks ago he vomited a small amount of "coffee-ground" material, and again a week ago. The pain is more severe than formerly and has no especial radiation. The epigastric region is said to be sore to the touch when the pain is severe. No relief is obtained by ingestion of food or soda. The appetite is good, but for a year he has limited his food to bread and milk and fried bacon, which seem to agree with him. He gets on better if he does not overload the stomach. His bowels are regular without cathartics, and he has noticed nothing peculiar about the stools. He thinks he has lost 15 or 20 pounds in weight.

Physical examination shows a pale debilitated looking man, who exhibits nothing abnormal except carious teeth and pyorrhea, and a rather low blood-pressure. There is no tenderness, mass or spasm in the epigastric region, which reminds us that unless a gastric or duodenal ulcer is close to complete perforation we do not expect to get local signs. The general physical

In the literature and accept a total of 90 reported since 1881, when the diagnosis first began to be certified by reliable microscopic examination. In addition to the 2 cases which we have been considering, 2 others of primary tuberculous mastitis have occurred in the Peter Bent Brigham Hospital which may be referred to briefly.

Miss E. E. H., twenty-one years of age, single, colored, Surg No 5002 admitted July 3 1916. A lesion of the left breast appeared following trauma. General physical examination failed to show evidence of tuberculosis. No involvement of axillary nodes. A partial resection of the breast was done, microscopic examination showed tuberculosis. The wound healed *per primam* except for a small area, and she was discharged with this clean and granulating.

Mrs. D. K. thirty-six years of age, married, white, Surg No. 4983 admitted July 1 1916. Spontaneous appearance of a tender lesion in the non-lactating breast seven weeks ago incision with persistent sinus. General physical examination failed to show any evidence of tuberculosis elsewhere. The breast was densely removed. Histologic examination showed tuberculosis. Healing was *per primam* and she was discharged well.

These 4 cases of primary mammary tuberculosis have occurred among a total of 228 surgical diseases of the breast admitted since January 1913 and operated on. This is an incidence of about 1.7 per cent., which compares with less than 1 per cent. reported by Denver and MacFarland and 1.3 per cent. reported by Scott. It seems likely that with more accurate diagnostic measures the percentage of cases of tuberculosis among patients with benign lesions of the breast will be found to be larger than we have supposed.

Scott, Sidney: St. Bartholomew's Hosp. Rep., 1903, xl, 97

pylorus and because a chronic ulcer may exist for long periods without hemorrhage. Moreover if fresh blood were present, we should be obliged to consider traumatism by the tube as a probable cause. The fluoroscopic examination after the ingestion of barium gives concrete and visible evidence of a normal appearing stomach without filling defect due to tumor or crater due to ulcer and without the persistent deep incisura of the greater curvature so characteristically present at a point opposite a lesion on or near the lesser curvature. There is nearly complete six-hour stasis, which is evidently not wholly due to pyloric spasm, as it is only partially relaxed by belladonna. There is some hypermotility which suggests an ulcer at or beyond the pylorus, but we must bear in mind that this finding is important only in the presence of hydrochloric acid, since anacidity alone may cause it.

Each of the three means of investigation—the history the gastric analysis, and the fluoroscope—points to the same conclusion—a chronic ulcer at or near the pylorus, causing a considerable degree of obstruction. It is not profitable to insist on the differentiation between a prepyloric and a duodenal lesion, since the symptomatology and treatment may be exactly the same.

Before discussing the treatment of this case let us consider this second patient, who presents a somewhat similar picture. Mr W. E. B., twenty nine years of age, single, a steamfitter by trade (Med. No. 13,864, Surg. Nos. 13,073 and 13,991) has already been admitted twice to the hospital with the same complaint. His family history is good. His previous history reveals little that is significant, except an attack of typhoid fever at the age of twenty-one, and one attack of gonorrhea. There has been chronic constipation worse during the last two years, and moderate loss of weight. He has used alcohol moderately but occasionally to excess, he smokes 12 cigarettes daily and drinks 6 cups of coffee and 3 cups of tea.

He entered the medical service six months ago complaining of pain in his stomach. Two years earlier he had noticed a tendency to headache increasing constipation, and lassitude.

examination of patients with ulcer may be perfectly negative. Gastric analysis is somewhat unsatisfactory on account of stasis, but the presence of at least a normal amount of acid is established and the benzidin test for blood is negative. The stools are normal except for a positive benzidin test. The blood examination is consistent with a moderate degree of secondary anemia urine normal. Fluoroscopic examination after a barium meal shows that at the end of six hours but little of the barium has left the stomach, which is normal in position, size, and contour with deep peristalsis. This examination is repeated after giving the patient belladonna, and shows that the sphincter has relaxed somewhat, allowing a small stream of barium to pass through the pylorus into the duodenum. There is no filling defect about the pyloric end of the stomach. The studies suggest a non-malignant lesion involving the first portion of the duodenum and the sphincter.

The diagnosis of this patient's trouble presents no difficulties, with certain reservations. Each method of reaching a conclusion is supported by the next. The history of twelve years of epigastric discomfort and indigestion, occurring in periods of exacerbation and remission, the onset of pain two to three hours after eating, the tendency of the pain to occur at night, the restrictive limitation of food by the patient to bland substances which do not excite the secretion of acid, the story of regurgitation of a substance consistent in appearance with altered blood on three occasions, and the passage of tarry stools, are almost pathognomonic of ulcer situated near the pylorus. We miss, it is true, the usual story of relief brought by eating and by taking soda, and might expect nausea or vomiting to be more conspicuous. The physical examination does not help us, except in so far as the absence of palpable tumor or of enlargement of the liver constitute negative evidence of the existence of well-established malignant disease. The gastric analysis reveals the existence of marked stasis, and the presence of high normal amount of hydrochloric acid. There is no gross or occult blood, to which finding we attach little significance because we know that the ulcer may be situated beyond the

Five weeks later after observation in the Out-door Department, having showed no material improvement, he was admitted to the surgical service, but developed a boil in the epigastric region which precluded operation at that time, and he was discharged.

Five months later he was again admitted, with the story that in the interval his symptoms had been growing worse, the pain beginning immediately after meals and lasting two to three hours. His constipation was more marked. He had headache and dizziness. He had lost 10 pounds more in weight, was unable to eat or work, and desired operation if it offered a chance of relief.

Let us recapitulate this history and attempt a diagnosis. An unmarried man, twenty-nine years of age, seeks advice for a dull epigastric pain coming on soon after eating, lasting a variable time unaccompanied by nausea and vomiting sometimes relieved by cathartics. He describes macroscopic blood and tarry material in the stools. He has had annoying constipation and headaches. Physical examination is negative except for slight epigastric tenderness. Gastric analysis has shown no acids, a distinctly subnormal acidity and a positive benzdin reaction. Stools have shown nothing remarkable. Barium and x ray studies, made on three occasions, showed at the first examination nothing noteworthy but at the two subsequent ones a definite deformity of the duodenal cap was noted. Neurosyphilis has been excluded.

What importance shall we attach to these various data? The history is certainly not at all typical of gastric or duodenal ulcer but suggests rather the 'bilious' type of individual, debilitated possibly preoccupied with his own symptoms, since he has not much else to worry about. We regard a carefully taken history analyzed conscientiously as the most important means to a diagnosis of peptic ulcer. Nevertheless, we admit that the atypical case exists, if only to prove the rule. The physical examination here tells us nothing. The gastric analysis is strongly opposed to the diagnosis of ulcer. The positive benzdin reaction is of little value, because traumatism

Nine months before his first admission he began to have pain in the upper abdomen a few minutes after eating, which lasted from half an hour to several hours. It was steady rather than colicky, did not radiate, and was unaccompanied by nausea, vomiting, or belching of gas. He has never taken soda. The pain was sometimes relieved by catharsis. He has eaten but little on account of the pain, and five weeks before entrance he quit work. On questioning, he said that he had passed blood by rectum and described tarry stools. He had been first seen in the Out-door Department, where x-ray studies showed nothing but slight gastric stasis, and a diagnosis of gastric neurosis was made. He was under observation for a month, during which he continued to complain of pain after eating, and he was finally admitted to the medical service.

Physical examination showed a rather apathetic man, with no noteworthy deviation from the normal except some sensitiveness in the epigastrium. His blood Wassermann reaction was negative, and on account of his headaches a lumbar puncture was made and neurosyphilis excluded by examination of the spinal fluid. The gastro-intestinal studies were repeated, and this time there were noted a somewhat hypertonic stomach, without six hour residue but with a definite irregularity of the duodenal cap. The entire gastro-intestinal tract showed hypermotility. Gastric analysis showed no stasis, absence of free hydrochloric acid in the fasting contents, and a low normal acidity after a test meal. The benedict reaction was positive for blood. Several examinations of the stools showed a faintly positive benedict reaction on one occasion only. A re-examination by barium and x-ray again showed a deformity of the duodenal cap.

A consultation with the surgical service was held, and the opinion was expressed that a duodenal ulcer existed with typical history and symptoms. He was given a bland diet with alkalis after the manner of Sippy; his constipation was somewhat straightened out, and after five weeks he was discharged feeling much better with instructions to continue these measures. The diagnosis was duodenal ulcer and chronic constipation.

These 2 cases have been operated on. The first patient showed a chronic indurated ulcer on the lesser curvature just proximal to the pylorus which was not actually involved. There were extensive old adhesions fixing the pylorus and duodenum to the under surface of the liver and to the gall-bladder which with edema of the tissues and pyloric spasm account for the gastric stasis. The ulcer was excised with the cautery the defect repaired, and a posterior gastrojejunostomy done. He is now two and a half weeks later ready for discharge, having had a normal convalescence. The operation has given him complete relief from ulcer pain he is eating a more liberal diet than for years and a fluoroscopic examination shows the barium passing almost entirely through the stoma. The second patient, on exploration, showed absolutely no organic lesion of the viscera, although each and every one of them was examined by sight or by touch. The pylorus and duodenum showed no irregularity or adhesion or change to account for the fluoroscopic findings. The appendix contained fecoliths, and was removed. Its histology was negative. The patient is convalescing normally and thinks he feels very much better. We shall emphasize the removal of the appendix, using it as a legitimate means of suggestion therapeutics. We regret a negative exploration but in a case of this sort, after having exhausted every means to reach a diagnosis, we consider exploration justifiable and relatively harmless.

It is tempting but impossible here, to enter far into the discussion of the relative merits of medical and surgical treatment of peptic ulcer. At one extreme stands the medical enthusiast, who believes that he can cure nearly every case by rest, diet, and the neutralization of gastric acidity and that surgery is usually unnecessary frequently ineffective and sometimes fatal. At the other extreme stands the surgeon who knows that he can operate on these cases with an almost negligible mortality and with a very high percentage of permanent relief who numbers among his cases a large number who have been for months or years in competent medical hands, and who occasionally finds at operation an early malignant process susceptible of

of the esophageal or gastric mucosa cannot be excluded. The hypo-acidity amounting at one examination to an absence of uncombined acid, is strongly against ulcer which is usually characterized by a high, or at least a normal acidity. Probably not more than 5 per cent. of ulcer cases show hypo-acidity. The x-ray examination is our stumbling-block. Negative at first, it has shown deformity of the duodenum on two subsequent occasions, and our roentgenologist has felt justified in making a diagnosis of ulcer. We have the greatest respect for this opinion, because the roentgenologic diagnosis of ulcer has attained astonishing accuracy. A persistent crater on the profile of the lesser curvature is practically pathognomonic of an ulcerative process, but without it, the finding of six-hour stasis and a persistent incisure on the greater curvature constitute important evidence of gastric ulcer while gastric hypermotility and deformity of the duodenum are equally reliable evidences of a duodenal lesion. In this case the observation of duodenal irregularity is not much strengthened by the slight hypermotility which may be accounted for by the hypochlorhydria.

We feel grave doubts as to the existence of an organic lesion in this case and are inclined to place it in the class of neuroses. How much would our diagnostic problems be simplified if we had any accurate criteria of the neurotic temperament! One point in this patient's history we are inclined to emphasize namely the fact that he has reached his thirtieth year without marrying. It may seem far-fetched to associate this with a neurasthenic tendency but we observe it so often that it is worth mentioning. The overwhelming majority of men of the working class marry and usually marry comparatively young, and when this normal expression and fruition of a powerful physiologic instinct has not been sought, it argues the possibility of some neuropsychic deviation from the normal. This observation does not hold true however with the brain workers, where the intellect dominates the physical or somatic functions and furnishes, to some extent, substitute for their consummation.

